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By

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From ~~Cable~~ to ~~Ouvrier~~

Dais to Fut

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DAIS. Canopy. Hood.

The name given to projecting stones more or less ornamented by sculptures, destined to cover statues on exteriors and even in the interiors of religious and civil edifices of the m middle ages. The artests of that epoch did not find it proper to place a figure of a saint or a celebrated personage against a wall without protecting its head from the rain or dust by a sort of small canopy belonging to the structure. Yet only dating from the 12 th century, canopies almost without exception were placed above external statues. Sometimes in that epoch, as for example on the front of the porch of the church of Moissac, canopies were merely a low course or slab cut in arch form at its sides (1). Yet one sees in the monuments of the 12 th century richly decorated canopies already, and that represent little monuments suspended over the statues. The church of S. Sauveur of Dinan shows us two canopies beside the p portal, important in size and deficately wrought, that cover the figures of saints. Cut in friable granite, they are unfortunately very much changed by time. Sometimes statues being placed against columns, the canopies are also fixed to their shafts. Then the column and the statue, its support of the c canopy are all cut from a single block of stone. On the royal portal of the cathedraloof Chartres are noted, suspended over the heads of the figures from the 12 th century, that decorate those portals; several canopies in a fine style. we give one of them here (2).

Canopies frequently furnish us with varied motives of the crowning parts of edifices, i.e., of certain parts of these edifices, which ara almost always destroyed or modified. It is to be noted even in the 12 th and 13 th centuries, that these little models generally reproduce examples of edifices before the epoch at which canopies were sculptured. This fact may perhaps be observed above the statues of the central portal of the western facade of the cathedral of Paris (3). These canopies again represent domes and flat roofs, such as were no longer built in that part of France.

The canopies protecting the statues of the 12 th century a and of the beginning of the 13 th, placed in the jambs of the portals, are cut on a different model. Each statue has its s separate corbel and its canopy. Yet there is a very remarkab-

remarkable exception to that rule at the portal of the Virgin on the western facade of Notre Dame of Paris. The statues that ornament the two jambs of that portal are surmounted by a series of canopies entirely alike, that form above the heads of those statues a shelter in a style not common. The sculpture of the portal of the Virgin further is impressed by an original character, and we know nothing of that epoch (1215 to 1220), that can be compared in grandeur of composition and beauty of execution. Here (4) is how those canopies are arranged to form a sort of entablature above the capitals of the little columns placed behind the statues, not confounded in the capitals themselves, as practised elsewhere.

The religious monuments of Burgundy have nearly all been d despoiled of their external statues. In that province the revolution of the last (18 th) century mutilated churches with more fury than in Ile-de-France and the provinces of the West. Casting down statues, the rage of the iconoclasts did not respect what accompanied them, and the sculptures of the portals were not only broken, but were cut away to the wall, as may be seen at Semur, Beaune, Notre Dame of Dijon. The few canopies that remain in that province from the beginning of the 13 th century cause regret, that they have been destroyed almost everywhere, for those rare examples are admirably composed a and sculptured. This may be judged by the example here given, (5), which came from the portal of the little church of S. Pere-sous-Vezelay. This canopy was painted like all the sculpture of the portal. The statue was placed against the little column A, whose capital is intersected by the canopy.

Already at that epoch Burgundian canopies are surmounted by little shrines in the form of a pyramid or tower, set on the course engaged in the structure. That superfluity is only found later on the edifices of Ile-de-France and Champagne.

About the middle of the 13 th century, at the moment when architecture became more delicate and the ornamentation finer, canopies are frequently covered by an extreme richness of sculpture, then there are little castles crowned by towers with battlements and their keep. In the interior of S. Chapelle of Paris, above the twelve apostles attached to the piers, are seen canopies with battlements, whose turrets are pierced by windows filled with blue or red glass. But the most remarkable

canopies of that kind that we know, exist above the figures of
[illegible]
[illegible]
stand of the jamb statues are varied in form and dimensions; but from the middle of the 13 th century the canopies of the same series of figures are habitually similar and form a series of uniform arcades, as may be seen on the western portal of the cathedral of Rheims (7). Yet they are not again crowned by high overtaics, unless in Burgundy, where were already seen at the middle of the 13 th century some canopies terminating in the form of pinnacles or turrets. During the 14 th century canopies assume much importance, are covered by details, and are cut in the form of little vaults very carefully wrought. Sometimes in the jambs of portals, beneath
[illegible]
certain distances by slender piers, between which are set the figures. Pinnacles so arranged are to be seen under the lateral western doors of church S. Urbain of Troyes (8), and beneath the porch of Semur in auxois. Then instead of placing them on corbels, the statues stand on a continuous projection A receiving the little piers A, Fig. 8; thus they are scattered beneath a deep gallery, can assume varied movements, which each other, form a part of the same scene, like the adoration of the Magi, the presentation at the temple, the baptism of Jesus Christ, etc. That novel arrangement lent itself to the dramatic sentiment, already sought by statuary at that epoch.

Note 1.t.A. That portal is now engaged in a scaffolding, all the sculpture is very beautiful; the statues of the twelve apostles have been removed from that portal and deposited in the cathedral a short time since.

Above isolated statues, either placed in the interior or on the exterior of edifices in the 14 th century, canopies are generally surmounted by high open overtures, that present numerous pinnacles, and resemble all the terminations of the turrets of that time. (Art. Pinnacle).

Without notably changing the forms of these canopies of the
[illegible]
as are still seen in the architecture of the 15 th century than the figures: they are sculptured to excess, covered by

canopies of that kind that we know, exist above the figures of the north portal of the cathedral of Bordeaux (6).[1] Wntil that epocn as we have just stated, the canopies of the same arrangement of the dajacent statues are varied in form and dimensions; but from the middle of the 13 th century the canopies of the same series of figures are habitually similar and form a series of uniform arcades, as may be seen on the western portal of the cathedral of Rheims (7), yet they are not again or crowned by high pyramids, unless in Burgundy, where were already seen at the middle of the 13 th century some canopies terminating in the form of pinnacles or turrets. During the 14 th centsry canopies assume much importance, are covered by details, and are cut in the form of littel vaults very c carefully wrought, sometimes in the jambs of portals, beneath porches, they represent a separated small arcade supported at certain distances by slender piers, between which are set the figures. Pinnacles so arranged are to be seen under the unfinished western porch of church S. Urbain of Troyes (8), and beneath the porch of Semur in Auxois. Then instead of placing them on corbels, the statues stand on a continuous projection A receiving the little piers A, Fig. 8; thus they are sheltered beneath a deep gallery, can assume varied movements, touch each o her, form a part of the same scene, like the adoration of the Magi, the presentation at the temple, the baptism of Jesus Christ, etc. That novel arrangement lent itself to the dramatic sentiment, already sought by statuary at that epoch.

Note 1.p.4. That portal is now engaged in a sacristy, all the sculpture is very beaut ful; the statues of the twelve a apostles have been removed from that portal and deposited in the cathedral a short time since.

Above isolated statues, either placed in the interior or on the exterior of edifices in the 14 th century, canopies are generally surmounted by rich open pyramids, that present nothing particular, and resemble all the the terminations of the turrets of that time. (Art. Pinacle).

Without notably changing the forms of these canopies of the 14 th century, the 15 th century only exaggerated them; canopies are still seen in the architecture of the 16 th century over the figures; they are sculptured to excess, covered by

infinite details; such are these of the portal of the cathedral of Tours, those of church S. Michel of Dijon. It seems useless to give examples of these last details, which are in the hands of everyone. The wooden choir stalls of churches were s surmounted by canopies, that protected the religious from cold. These canopies are of great importance as a work of joinery. (Art. Stalle). Sometimes seated statues of Christ or of the holy Virgin dependant on reredoses, or are placed in the tympanums of portals or even of gables of churches, are sculptured under a canopy supported by columns, arranged like an altar c canopy. This sort of crowning accompanying the sacred figures merits the entire attention of artists, for then furnish examples of those internal decorations of sanctuaries, now destroyed in France without exception. A very curious reredos from the beginning of the 12 th century, and that was some years since the subject of a suit between the State and the board of a manufactory, that had sold this article to a dealer in curiosities (suit gained by the State, at the end of which t the relief was replaced in the church of Carrieres-S-Denis n near Paris), and which is composed of three subjects; an annunciation, a baptism of Jesus Christ, and at the middle a seated figure of the Virgin holding the Child on her knees. The Virgin is surmounted by a canopy representing the celestial Jerusalem supported on two columns.(9). At the cathedral of Chartres, in the tympanum of the royal portal is to be seen t the Virgin in the same attitude, surmounted by a canopy. At the cathedral of Paris, the portal of S. Anne presents at the summit of its tympanum a magnificent canopy protecting the s seated statue of the mother of God. Art. Arche d'Alliance in this Dictionary gives a drawing of the canopy placed over the statue attached to the pier of the portal of the Virgin. (Same edifice).

DALLAGE. Pavement. Floor.

From all times in all countries have been employed to cover the areas of great floors, either in public edifices or in p private habitations, flat stones, polished and jointed, hard, without order or symmetry. Most limestone quarries possess in their upper layers a compact texture, suitable for this kind of paving. The Romans employed for pavements precious materials,

such as marble, porphyry, granite, evey jasper, and that with singular prodigality. There still exist some of these pavements, which are noted for the grand and simple arrangement of the design and the beauty of the materials employed; such are the pavements of the Pantheon of Rome, of the basilica of the forum of Trajan. The architects of the middle ages did not p possess these precious materials, like the Renaissance, and h had they possessed them, they no longer had facilities for c cutting them in large slabs and for polishing them. When they wished to decorate the areas of edifices, they then adopted the simplest and least expensive methods. From the Byzantine epoch the Greeks had endeavored to decorate the plane surfaces of therr monuments, vertical or horizontal, by means of inserts of colored marbles or inlays of colored cements in the slabs of white marble or limestone. Thus were obtained designs of great richness, very varied and refined, with materials easily procured; this was merely an affair of workmanshif. Th These procedures were employed in France from the 12 th century, and perhaps even before that epoch, although examples a are absolutely wanting for us. Gregory of Tours speaks of pavements of churches of great magnificence; but it is to be believed that those pavements were made according to the antique processes, and perhaps even with the remains of Roman monuments, or were composed of rude mosaics, such as one finds s still in such great number over the surface of France. (Art. Mosaique).

During the middle ages in France mosaic was but very rarely employed, and this sort of pavement composed of small pieces of hard stone forming interlacings, and known under the name of opus Alexandrinum, so common in Italy and Sicily, is found but exceptionally; then it is evidently imported from Italy. Such pavements are seen in the sanctuary of the abbey church of Westminster in London, and in that of S. Benoit-sur-Loire. That importation was not imitated by our clerical or lay architects. Then adopted by preference pavements of hard limestone, and when they desired to decorate these, they engraved d designs on their surfaces, which they filled with lead or cements, gold, black, green, red, brown, light or dark blue. Two causes contributed to destroy these pavements; first the frequent passage of the believers over their surfaces by their s

shoes, then the custom generally adopted from the 13 th century of interring clerics and even laymen beneath the pavements of churches. Thus many old pavements were removed to give place to tombstones, which in their turn formed a rich ornamentation obtained by the same processes of engraving and inlaying. (Art. Tombes).

The most ancient fragments of engraved pavements possessed by us came from the church of S. Menoux near Moulins. These fragments (1, 1 bis) date from the 12 th century; they are of white stone inlaid with resinous black cement. The piece of pavement (Fig. 1) forms the ground; that of (Fig. 1 bis) is t the border.

The numerous fragments of engraved and inliad pavements still to be seen in the old cathedral of S. Omer, and which were published by M. E. Wallet,[1] present us with the most complete s specimen of this sort of work, and which formerly decorated t the areas of choirs and apsidal chapels of the principal churches of France. These fragments evidently belong to different epochs;[1] now displaced, they originally formed a part of the pavements of the choir and of several chapels, and were not executed at the same time. Conformably to the method employed in the sculpture of the middle ages, each slab with some exceptions was covered by a complete design, and the entirety of the composition was obtained by means of placing these slabs adjacent. Thus the pavement was dressed and finished in the workshop before setting. Designs are very varied, several of these slabs belong to the end of the first half of the 13 th century, and represent warriors on horses, only covered by the shield and holding a pennon with their arms. Some inscriptions are read around the figures, and indicate that this pavement was made by means of gifts, each slab having been given by the personage represented.

Note 1.p.10. Desc. du pave. d.l.anc.cath. d.S. Omer,1847.

Note 1.p.11. M. Vitet in a report to the minister of the interior (1830), regards these slabs as belonging to the end of the 12 th century. M. Hermand does not believe them earlier than 12?0. The fact is that they do not all belong to the same epoch; some of these slabs have all the characteristics of the drawing of the beginning of the 13 th century; others are more recent.

Here (2) is one of those engraved stones, around which is r read this inscription:--"+ Egidius, son of Fulco of S. Aldegunde gave this stone in honor of the blessed Audomari."

The ground is brown as well as the inscription, and the lines of the figure and horse are red. Other slabs of stone result from the same decoration, composed of a combination of squares, representing grotesque figurer, ornaments, persons seated on a throne. A series of slabs of smaller dimensions, and which appear to belong to the beginning of the 13 th century, represent the liberal arts, a zodiac with the labors of the year.[1] A third numberous series of little squares of stone contains a considerable number of fanciful animals and ornaments of beautiful character, whose drawing dates at the end of the 12 th century or beginning of the 13 th. M. E. Wallet[2] has attempted to restore the entore composition of these slabs, and he separates them by means of bands made of little squares of black marble. We do not think that this restoration can be accepted, first because in the engraved slabs of which we possess still existing entireties, like those of S. Nicaise of Rheims, S. Denis, and of Canterbury, nothing is found to justify that hypothesis; then because in execution the contrast of these plain bands with those delicate designs produces the worst effect, as we have recognized. The plain bands of black or dark red combine perfectly with tiles of glazed terra cotta (Art. Carrelage), whose tones are vivid and brilliant, and which are of the same material as these bands; but that harmony cannot exist between stones whose fine engravings are filled with colored cements and squares of black marble, whose appearance is always hard and cold. The bands of black marble absolutely destroy the effect of the engravings. In the lack of a great number of existing monuments, we possess drawings of the late Percier in the abbey of S. Denis, these drawings give a number of pavements composed of engraved stones, and n none of those pavements presents bands or enclosures of colored stones; on the contrary it is certain that the architects desired to obtain in their pavements that tranquil harmony of engravings, which suits so well a horizontal surface made for walking on. It is displeasing to place the feet on a pavement, whose violent tones suggest projections and hollows. The artists of the 12 th and 13 th centuries had sufficient instinct

in the effects of color in edifices to carefully avoid these defects.

Note 1.p.14. In the cathedral of Canterbury is still seen the zodiac thus engraved on the slabs of the choir, which dates from the 13 th century.

Note 2.p.14. Plate VIII.

The engraved slabs that decorate the areas of several apsidal chapels of the abbey church of S. Denis in France were very beautiful. They still exist in part, and have been restored to their old position, or are reproduced in the Album of the late Percier.

We give here (3) a part of the pavement of the chapel of S. Osmane. The step of the latar, a portion of which our plate shows at A, represents four virtues with a border of very delicate ornaments composed of quatrefoils containing fanciful animals. Around that step and raised 5.5 ins. above the pavement of the chapel are developed in the circular medallions s subjects representing the labors and pleasures of the 12 months of the year. (Art. Zodiaque). That border is relieved by black grounds, and is detached from a simpler ground composed of large quatrefoils with rosettes, between which are engraved symbolical animals, hunting slenes mingled with foliage. A narrow border B encloses the entire composition. One will note how delicate is the ornamental appearance of this rich pavement, without being confused, the artist took care to make the ornaments on the step of the altar on a scale much smaller than that of the ground of the pavement, so as to give that raised step something particularly precious. The general design is understood at a distance, and near by it attracts the eyes by the graceful combination of the engravings, that are all filled with black cement. Sometimes, as in the chapel of S. Peregrine of the same church, the pavement is composed of a uniform design enclosed by a border or an inscription (4). This pavement of which we give here a fragment at 1/4 scale is likewise of lias. The ground of the fleur-de-lis is black, that of the rosettes is olive green, the rosettes are red as well as the inscription, little cubes of gilded glass inlaid at A prevent the entire decoration from appearing a little dark.[1]

Note 1.p.16. Those glass cubes are made like those found in all Italian mosaics of the 13 th century (called Byzantine).

i.e., the gold leaf is laid on a paste and is protected by a covering of very thin glass.

The drawings of the pavements of S. Denis have great purity; the figuers are traced by the hand of a master and in a remarkable style. All these pavements belong to the restorations o ordered by S. Louis in the old abbey church, i.e., they date from the middle of the 13 th century. The engravings are,made in the very hard lias, sunk about 3/16 inch and filled with cements, black, red, dark green, light blue and brown. In places are inserted pieces of colored or greenish white glass, p painted and gilded beneath to fix this, or also little cubes of gilded paste as in the preceding Fig. Some of these beautiful pavements have been repaired and replaced; their effect is that produced by a rug of very soft and harmonious tones.

There still exist in the church of S. Remy of Rheims a portion of the pavement, that formerly covered the area of the choir of S. Nicaise of the same city. This pavement dates from the first years of the 14 th century, and represents scenes from the old Testament inscribed in square compartments (5). Each slab bears a subject, and that we have chosen represents Moses, Aaron and Hur, during the battle fought by Israel against Amalek.[1] The incised lines are there filled with lead without any coloring. It is unnecessary to say, that this sort of pavement costs very dear, and that they could only be placed in rich churches, in sanctuaries of some privileged chapels. Men were frequently satisfied with uniform pavements or those composed of black and white squares. That the designs are varied, but the squares are at the scale of the monument and g generally of small dimensions.

Note 1.p.18. S. Remy de Rheims, dalles du XIII siecle, pub. by M. Tarbe. Rheims. 1847.

The cathedral of Amiens still retains nearly all its pavement of the 13 th century, which only consists of small blocks 1.05 ft. square, black and white, forming a different design in each bay. Here (6) is one of these cominations. To judge of the effect of this pavement, now very much deteriorated, it is necessary to ascend the galleries and to observe it a from above at that distance, the compartments are very happily combined; in the nave they were interrupted by a great labyrinth also formed of black and white squares. (Art. Labyrinthe).

These pavements of an early date are not very common. Remains from a more recent epoch are found in many little churches too poor to have rplaced those old pavements. The church of Orbais possesses a pavement of the 15 th century (7) composed of little squares of black marble 5.5 ins on side and oblong white slabs set so as to represent a sort of matting with good effect. These designs, however simple they may be, are never vulgar. Pavements were employed not only in public edifices, but also in private habitations. Most of the great halls of castles, palaces of bishops and city halls were paved with g great slabs of hard stone. Frequently even in castles, these pavements were decorated by inlays of colored stones or cements, or even the stones alternated with painted stucco. In an account of the construction of the castle of Bellver in the island of Majorca,[1] there is a question of the pavements of t that feudal habitation, "made of stucco composed of live lime, plaster and great stones mixed with color; the whole so well polished, than one could believe these surfaces to be made of marble or porphyry." The ancients had understood the importance of pavements as a means of decorating interiors of edifices, and the middle ages only followed and perpetuated that tradition. Indeed we may say, that it was necessary to have lost the sense of decoration, to allow in an interior decorated by sculptures, paintings and colored glass, gray pavements of uniform tone, which by the extended surface occupied, assumed a value such that all ornamentation of the walls however rich was destroyed, or at least chilled, Colored pavements are one of the most splendid and pleasing decorations, that one could imagine. In France as in Italy, the middle ages did not fail to employ this sort of decoration, now too rarely applied.[1]

Note 1.p.19. This account begins on April 1, 1309, and ends at the end of December, of the same year. Melang.geog.et hist. of Jovellinos, edit. of 1845. Vol. 3. Madrid.

Note 1.p.20. It is only since the last (18 th) century, that has ceased to be employed colored pavements in edifices; and again under Louis XIV were executed magnificent pavements; we shall cite among others those of the great chapel of Fontainebleau, and of the choir of the cathedral of Paris, the last is a masterpiece. It is restored and replaced.

DALLAGE EMPLOYE COMME COUVERTURE.

Stone Slabs for Roofs.

When men had the diea of replacing the carpentry covering of halls and aesles by vaults, they thought to protect the extrados of these vaults by stone slabs or large tiles set in mortar; this system of covering also perfectly was perfectly applicable to tunnel vaults, semicircular or composed of pointed arches. In south France, Provence, on the banks of the Rhone and in the Centre, are still seen churches with vaults covered thus by superposed tiles (8). But one recognizes soon, that however well executed were these roofs, and however good were the stones employed, yet those stones by capilarrity absorbed a great quantity of water, and maintained a permanent dampness on the vaults; one also recognized that from the moment that the slabs were isolated from the extrados, the effect of capilarrity ceased, or at least dampness was no longer communicated to the vaults. Thus men thought about the beginning of the 13 th century, of placing the stone slabs on arches above the vaults, so as to allow the air to circulate between the underside of the slabs and the extrados of the vaults, and to combine these slabs so as to avoid uncovered joints as much as possible. constructors also recognized that the slabs having quite a small slope, it was necessary to hasten the flow of rainwater over their surfaces to avoid deterioration of the stone, on which the raiu did not flow rapidly. Consequently they took care to cut the external surface of the s slabs in hollowed form (9). By this means the water collected at the middle of each slab found a sufficient volume to produce a rapid flow, even during the fine rains, that more than t torrents penetrate and destroy limestone. Yet the joints of t this sort of slabs were not sufficiently raised to not be soaked during a shower; they soon gave a decided profile to the edges of the slabs, so as to raise the joint entirely, and no longer expose it except to drops of water falling directly fr from the sky. Thus are executed the stone terraces of the cathedral of Paris, set on arches and completely isolated from the vaults (10). Those great slabs are still slightly hollowed witha channel along their middle, so as to hasten the discharge of the water by forming little streams at these middles. Besides, the lap A of each slab is cut with a drip as indicated

by the section A', to prevent the water wetting the edge from aslending the bed E by the effect of capilarrity or by a violent wind.

The stone roofs of the terraces of Notre Dame of Paris rest (as shown by our Fig. 10) on purlins B of hard stone supported on arches turned at certain distarces and according to the horizontal projeltion given by the arches of the vaults, so as not to multiply thrusts. At the upper and lower edge of t the slope, the slabs rest on t e gutter D and on a projecting course C inserted on the wall.

A workman entering beneath these stone roofs by means of t traps arranged for that purpose and pierced as indicated by the sketch G, could examine the vaults, repair them, even rebuild them under cover, assure himself of the condition of t the joints of the slabs, remove and replace them easily if they deteriorated. Certainly the external appearance of the architecture demands from the architect an assured taste, a perfect knouledge of the resources of his art; but this care applied in the combination of the parts of the construction, which substantially contributes to the preservation of edifices and their easy maintenance cannot be too much recommended, for it is by this attention to the least details that one recognizes the true master of works, whose mind both comprises the general conception and the intimate organization of the e edifice, which he constructs. In that respect it must again be confessed, that we have much to learn from these unknown artists of past centuries.

One also finds examples of stone roofs with less simple combinations, but even more suitable to avoid maintenance, because no joint is uncovered. These roofs are combined nearly like the marble or terra cotta coverings of Grecian edifices in antiquity. light arches (11) are spaced to receive the rows of superposed slabs; on the rows of slabs serving as channels are placed other rows of slabs forming a complete covering, as s shown by the section A. In this sort of roof, there is no need anywhere of cement or mortar to caulk the joints, that are all covered. Thes sort of stone roof is found in the church of Chaumont and on the collegiate church od Poissy. These stone roofs are always dear, because they multiply the arches and require much cutting.

[illegible]

DENTILS. Rows of Dentils.

[illegible]

the 12 th century to decorate bands, archivolts and cornices of stone edifices; with billets and sawteeth (Arts. Billettes, [illegible]

[illegible]

composed of horizontal or annular mouldings or spots of snake very simply obtained without having recourse to sculpture. P particularly in Ile-de-France, Soissonais and Normandy is found the use of these dentils dating from the end of the 11 th until the beginning of the 12 th centuries. The course of the base of [illegible] was crowned in its upper part by a beautiful cornice composed of 4 rows of dentils, three of which are still in place around the apse.

Here (?) at A is shown how these dentils are cut, each series being made in a course 4.5 ins. high.

Sometimes two rows of dentils are cut in a single course B.

[illegible]

sculpture. They also in Normandy cover the surfaces of walls, of the inclined surfaces of buttresses; then they represent wooden tiles. This was a rather excessive means of giving richness to tympanums and to the surfaces of walls, whose appearance seemed too [illegible].

[illegible]

Gutters consisted of a ledge channeled to turn water into a channel stone. From the 13 th century leaders of lead were employed; (Arts. Corniche, Construction); we know none existing from this date (plain) before the 15 th century. One may yet see a spout in cast iron of that epoch attached to the base of a house located opposite the royal portal of the cathedral of Chartres. Fig. 1. gives a sketch of it. When leaders were attached to edifices in the 13 th and 14 th centuries, these spouts (i.e., the cutter openings of these pipes) are composed of a stone hollowed out to turn the water into the channel to receive it.

[illegible]

There are in architecture two species of decoration, the [illegible]

DALLES. (Art. Dallage). Tombstones. (Art. Tombeau).

DAMIER. Rows of Dentils.

This is an architectural ornament frequently employed during the 12 th century to decorate bands, archivolts and cornices of stone edifices; with billets and sawteeth (Arts. Billettes, Dents-de-Scie) it forms geometrical sinkings that break the monotony of horizontal or annular mouldings by spots of shadow very simply obtained without having recourse to sculpture. P Particularly in Ile-de-France, Soissonais and Normandy is found the use of these dentils dating from the end of the 11 th until the beginning of the 13 th centuries. The church of Notre Dame of Paris was crowned in its upper part by a beautiful cornice composed of 4 rows of dentils, three of which are still in place around the apse.

Here (1) at A is shown how these dentils are cut, each series being made in a course 9.8 ins. high.

Sometimes two rows of dentils are cut in a single course B. Then they ornament the upper slab of the cornice, a band or an archivolt. They also in Normandy cover the surfaces of walls, of the inclined surfaces of buttresses; then they represent wooden tiles. This was a rather expensive means of giving richness to tympanums and to the surfaces of walls, whose appearance seemed too cold.

DAUPHIN. Spout. Outlet. Dolphin.

Bottom opening of a leader recurved to cast water into a channel stone. From the 13 th century leaders of lead were employed; (Arts. Conduite, Construction), we know none taking the form that gave this name (Dolphin) before the 16 th century. One may yet see a spout in cast iron of that epoch attached to the base of a house located opposite the royal portal of the cathedral of Chartres. Fig. 1. gives a sketch of it. When leaders were attached to edifices in the 13 th and 14 th centuries, these spouts (i.e., the bottom openings of these pipes) are composed of a stone hollowed out to turn the water into the channel to receive it.

DECORATION. Ornamentation. Decoration.

There are in architecture two species of decoration, the d

decoration fixed on the edifices, and the occasional decoration attached on the occasion of certain solemnities. The fixed ornamentation during the middle ages belonging to the construction, it is unnecessary to devote to it here a special Article, and we refer our readers to all those Articles treating the parts of edifices capable of being ornamented, particularly the Arts. Sculpture and Statuaire. As for temporary ornamentation, it was applied in all times. The ancients decorated their temples with flowers, foliage and tapestries on certain occasions, and in that the Christians only followed their example. It only appears that during the middle ages, that within the churches were used temporary decorations, which could change the arrangement of the apparent form of those edifices. There were hangings attached to the piers or walls, garlands of leaves, heraldic shields, also sometimes scaffolds covered by tapestry intended to receive certain personages, and particularly exhibitions of objects forming rich treasures of abbeys and cathedrals. There may be found in Dictionnaire du M Mobilier details of this sort of decorations. What should be observed in temporary decorations formerly employed is the care applied by the decorators in the selection of the scale of the ornaments. These are always in proportion to the monument to which they are applied. Most of our modern temporary decorations, because of the neglect of this essential rule, destroy the effect that an edifice should produce instead of increasing it.

DELIT. On edge. (Art. Lit).

DENT-DE-SCIE. Sawtooth. Chevron.

A term employed to denote a species of ornament, that is s seen to originate in the 11 th century, and that was much used during the 12 th century, especially in the provinces of Ile-de-France, Normandy and the West. Sawteeth particularly serve to decorate bands, cornices and archivolts. The oldest are u usually wide, form right angles, and have small relief. (1). They soon become closes and acute (2), are strongly detached from the ground parallel to their face A, or from the leveled ground B. Toward the end of the 12 th century, the reentrant and projecting angles are truncated like D. Sometimes when t the sawteeth of that epoch are of small dimensions, particul-

particularly in the monuments of the West, they are again cut with right angles G. doubled sawteeth are cut as indicated in Fig. 3, so as to present a row of points passing over the others. On archivolts several rows of sawteeth are superposed, alternating and forming the projections indicated at E.

According to the method employed by the architects of the middle ages, each row of sawteeth was cut in the height of o one course, the vertical joints falling in the recesses. As t these ornaments were cut before setting, and the stonecutters desired to lose no stone, it resulted that the sawteeth in t the same course were often unequal in width,sence it was always necessary to comprise a certain number of complete teeth in one stone, whatever its length. But these irregularities do not seem to have disturbed the architects; yet it must be said, that they are much more pronounced in edifices built with parsimony, like village churches, for example, than in important monuments. Sawteeth indeed belong to the middle ages; nothing in Roman edifices could give the idea of this ornament, which gives so much vivacity to mouldings, and that makes the nude parts of the architecture of so much value. (Arts. Batons Rompus, Zigzags).

DEVIS. Design with Specification and Estimate.

In the 14 th century this name was applied to a graphical p project accompanied by a written description indicating the works to be done [1] and the estimate for the works.

Note 1.p.28. "William de Longueil, Viscount of Auge, to the sergeant of the sergeantry of Pont-l'Evesque, we commend that the work of masonry suitable to be done to the bridge, mentioned in the specification, you will cause to be cried for the customary lowest bid at all the places in your sergeantry, w where such cries are accustomed to be made. The year 1343. Marche, coll. Millin.

The design being made, men proceeded to contract by rebates, nearly as practised in our days, except that to compete for t the contract, it was necessary to belong to the trade guild, and that it did not suffice to present one's self to the competent authorities with a certificate frequently given by favor. Estimates were made in a lump sum or in detail, if made in a lump sum, it was stated at the end of the description of

the description of the works to be executed, that these works amounted to so much; if detailed, each article of the works was followed by a price. The series of prices attached to the papers was not then in use, and the contracts were with actual forfeits. Our departmental archives still contain a great number of this sort of contracts. We do not know whether in the 13 th century the master of the works made out the general design, specifications and estimate for all that was required of him; what is certain is that during the 14 th and 15 th centuries, each chief of the guild was often called to make a specification and estimate for the portion of the work concerning him. These being made, he bid for the work with a forfeit; but then there was no award, i.e., no competition between men of the same trade.

[illegible]

[illegible]

A fallen angel, personification of evil. In the first monuments of the middle ages are found no representations of the devil, and we cannot state at what precise epoch sculptors and painters commenced to represent the demon in reliefs and paintings. Greek manuscripts of the 7 th and 8 th centuries, that represent the resurrection show the dead returning to life; but the painters only represent celestial spirits, the devil is absent from the scene. A Latin Bible of the 9 th or 10 th century,[1] ornamented by numerous line vignettes, shows us Job seated on the ruins of his house; the evil angel is speaking to him; he has a halo and is furnished with wings; in his left hand he holds a perfume-burner filled with fire; the toes of his feet have claws; this is one of the oldest representations of the devil known to us. Here the demon retains certain attributes of his primary power. In sculpture of the 11 th century in France the devil begins to play an important part; he appears on capitals of tympanums, he is found in all the scenes of the Old and New Testaments, as well as all the legends of the saints. Then the imagination of artists was pleased to give him the strangest and most hideous figures; sometimes he presents himself under the form of a human monster, often with wings and tail; sometimes under the form of fanciful animals.

[illegible]

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Note 1.p.28. William de *

DIABLE. Devil. Demon.

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Note 1.p.29. Imperial Library. Manuscrtpts $\frac{b}{2}$.

The capitals of the church of Vezelay date from the end of the 11 th century, are filled with these representations of the spirit of evil. Here is one of them, that represents the proud rich man, torn from his palace by three demons; (2); th this is one of the numerous visions of S. Anthony, that the sculptur has represented.

In Art. Chapiteau we have given a representation of the demon cast out of the golden calf by Moses, taken from the same church; it is one of the most energetic figures of that epoch known to us. In these primitive figures the devil acts or counsels; when he acts he takes the form of a man more or less deformed, provided with wings and sometimes with a tain ending in a serpent's head, his members being thin and fleshless, his hands and feet large, his hair ruffled, his mouth enormous and his body nude; when he counsels he takes the form of a fanciful animal, siren, dragon, serpent, toad, basilisk (b (bird with serpent's tail), a dog with human head. Already in the 12 th century, the authors of animal books strove to make real or imaginary animals, figures symbolical of the virtues or vices (Art. Bestiare); then in sculptures or paintings, w when one desired to represent a personage under the influence of a bad passion, he was accompanied by one of these animals, a symbol of that bad passion. In the mediaeval museum of the city of Avignon, we see a fragment of a capital of white marble from the 12 th century, representing Job reproached by his wife and his friends; beside Eliut, one of the friends of Job is a siren that seems to advise him (3). Now the siren during the middle ages is the symbol of falsity and deception. On th the portals of the churches of that epoch the vices are sometimes personified (Art. Vice), and the persons representing t the vices are accompanied by devils, who take pleasure in tormenting them. The devils also appear in parables or legends, as in the parable of the bad rich man, for example, and in t the legends of S. Anthony and S. Benedict, who according to the legends had very frequent relations with the devil. It wo would be useless to copy here the numerous examples of these monstrous figures; we shall content ourselves with indicating the characters given to the representations of the devil during the various periods of the middle ages. During the Romanesque period, the devil is a being that sculpturs or painters

endeavor to make terrible, frightful, who plays the part of a power with whom it is permitted to taka liberties. With the western sculptors of the 13 th century, laymen far advanced as artists, the Gaulish spirit begins to appear. The devil assumes a less terrible character; ; he is often ridiculous, his character is more depraved than frightful, his countenance is ironical rather than savage or cruel; sometimes he deceives, frequently he is duped. The scene of the weighing of souls, which occupies the principal place in the drama of the last judgment, shows us the devil that endeavors to incline one of the scales of the balance to his side, with very little loyalty. The demons that accompany the damned seem to rail at the troop of unfortanates dragged into hell; some of there subalterns in the asmy of the shades sometimes even have an air of brutal good humor, that can make one believe in a reconciliation. Yet the entirety of the infernal scenes sculptured at t the beginning of the 13 th centuryalways has a dramatic appearance designed to move. At the central portal of the cathedral of Paris, for example, the entire side occupied by the demons and the souls left to them on the left of Christ, is scluptured by a master's hand; some episodes are rendered in a moving fashion.(Art. Jugement Dernier). Among the voussoirs covered by demons and the damned seems enthroned a superior devil; he is crowned (4). His body is surrounded by a serpent; he is s seated on a group of personages, among whom are seen a bishop and a king. This sovereign devil is fat, thick lipped; he has enlarged breasts and seems to repose in his triumphs. Beside him are represented scenes of disorder, confusion and despair, rendered with energy and talent in execution truly remarkable. The painters and sculpturs of the middle ages have adopted a trinity of evil in opposition to the divine Trinity. (Art. T Trinite). From the end of the 13 th century the devil loses much of his ferocious character in sculpture and painting; he is relegated to the lowest rank, he is scoffed at and frequently has the countenance of this part; in many legends remade at this epoch, he is the dupe of pious frauds, like the celebrated legend of the monk Theophilus and that of the smith Biscornet, who is said to have made the ironwork of the doors of the cathedral of Paris. This smith lived in the 14 th century, and was charged with making the ironwork of the three principal

portals of Notre Dame.[1] Desiring to make a masterpiece, and f finding it very difficult to know how to proceed in this, he gave himself to the devil, who appeared to him and proposed to forge the ironwork on one condition, well understood, that Biscornet by written contract in regular form should deliver his soul to the spirits of darkness. The contract is signed, the devil sets himself to work and finishes the ironwork. Biscornet, aided by his infernal helper, sets the ironwork on t the two side portals; but when he tries to iron the middle p portal, the affair becomes impossible, because the central do doorway serves for the passage of the holy sacrement. The devil had not thought of that difficulty; but the contract not having been entirely fulfilled by one of the parties, Biscornet became again possessor of his soul, and the devil lost h his ironwork of the two portals.

Toward the end of the middle ages the devil is seen to have grown old, and no longer carries on his affairs. The plastic arts of that epoch only reproduce the spirit of the popular legends, whose last traces we have followed on the puppet theatre, where in spite of his tricks and chaftiness, the devil is always thrashed by Punch.

The great devil sculptured on the tympanum of the portal of the cathedral of Autun in the 12 th century is a frightful b being, well calculated to shock fresh imaginations; but the imps sculptured on the reliefs of the 15 th century are rather comic than terrible, and it is evident that the artists, w who carved them, cared very little for the wicked tricks of the spirit of evil.

Note 1.p.33. This ironwork dates from the end of the 12 th or the first years of the 13 th century, and the story of the smith-Biscornet is a popular legend; it merely indicates the tendency of minds in the 14 th century to only see in the devil a fallen power, easily overcome with a little skill.

DIEU. God.

The middle ages represent God by his works in religious m monuments; he was only represented in the scenes of the Old Testament, in the creation, when speaking to Adam, Cain, Noah, when he appeared to Moses. In the new law Christ alone represents divinity. If there exist images of God the Father, they

are found with the Son and the Holy Spirit.(Art. Trinite). Only in the epoch of the Renaissance did artists, sculptors or painters introduce God the Father in the scenes, that they depicted.[1] Yet one sometimes sees on the tympanums of portals of the 13 th, 14 th and 15 th centuries, representations of C Christ in his glory, on the day of judgment, God the Father as a bust and blessing; he has a cruciform halo, wears a long b beard, and his hair falls on his shoulders. At the end of the 15 th century, God the Father is generally covered by the tiara with triple crown, like a Pope. We do not know of a single statue of the 13 th and 14 th centuries representing God the Father; the sole divine personage taking a principal place in religious edifices is the Christ man or the Christ triumphant. (Art. Christ). The Virgin Marw and her Son both occupy the imaginations and the hands of artists. (Art. Vierge Sainte). It seems as if God had delegated to them his entire power over created beings.

Note 1.p.34. See Iconographie chretienne, by M. Didron. Improy. 1843. We refer our redaers to thot excellent work.

DOME. Dome.

Employed for cupola (improperly ?). Duomo in Italian means a cathedral or episcopal church; since many churches of Italy are surmounted by one or more domes, the part has been taken for the whole; men speak of the dome of the Invalides, of the dome of the Pantheon; they should say cupola of the invalides or of the Pantheon. (Not according to American usage).(Art. Coupole). Il duomi di Parigi, for an Italian is the church of Notre Dame of Paris, which as all know, is not surmounted by a dome.

DONJON.[2] Keep. Donjon.

Note 2.p.34. Dongier or doingier in old French means domination or power. (Old French poem).

The keep essentially belongs to feudalism; it is not the Roman castle, and is not the retreat, the last defense of the citadel of the first times of the middle ages. The keep commands the defenses of the castle, but it also commands the surroundings and is independent of the enclosure of the fortress of the middle ages, in that it has a separate exit to the co-

country. That essentially characterizes the keep and distinguishes it from a tower. There is no feudal castle without a k keep, as there was formerly no strong city without a citadel. Every good citadel must command the city and still remain independent in its defense..

In the middle ages it was the same with the caštle, and the keep was to the castle what this was to the city. The garrisons of the middle ages possessed one defense more than ours; driven from the city, they retired into the castle; that being taken, they retired into the keep; the keep being pressed too closely, they could still risk the chance of escaping by a postern skilfully concealed, or pass through the enclosing lines at night by a bold stroke. But that arrangement of the keep belonging to a feudal fortress was not alone made to resist or to escape from the enemy outside, it was the result of the feudal system. A lord, however peaceful, only held his power from his vassals. At the moment of peril, they must appear at the call of the lord, id necessary shut themselves within the castle and aid in its defense; but it occurred that the vassals were not always faithful under every test. Frequently the enemy won them over; then the betrayed lord had no other refuge than his keep, within which he shut himself with his own men. It then remained to him as a last resource, either to d defend himself to extremity, to take his time to escape, or to surrender.

We have said elsewhere (Art. Ĉhateau), that the system of the defense of places dureng feudalism was only a series of means accumulated by mistrust, not only of a declared enemy, but of the garrisons themselves. That is why the study if the fortresses of that epoch furnishes an Inexhaustible subject for interesting observations; mistrust sharpened the mind and made it find resources. Indeed if some castles present nearly similar arrangements, on the contrary keeps offer an infinite variety, both in the general conception and in the details of the defense. Since the lords at any moment might be at war w with each other, greatly preferred that if their neighbors a attacked them, that they should not find defenses arranged l like their own. Each aimed thus to defeat his enemy, sometimes a friend of the day before; thus when the lord received his equals in his castle, even if friends, he took care to l

lodge them in a special building, received them in the great hall, in the apartments of the ladies, but very rarely took them into the keep, that was closed and menacing in time of peace, while they gave each other evidences of friendship. I In time of peace the keep contained the treasures, arms and archives of the family, but the lord did not lodge there; he only retired there with his wife and children, when it was n necessary to call a garrison into the enclosure of the castle. Since he could not live there and defend himself singly, he then surrounded himself by a greater or lesses number of men at arms in his pay, who were shut up with him. From thence e exercising a minute oversight over the garrison and the outside (for the keep is always placed at the weakest point of the fortress), his faithful men and himself held it with regard to the vassals and their men crowded in the barracks; at any hour being able to make a sortie and retsrn by concealed and well guarded exits, the garrison were ignorant of the means of defense, and naturally the lord did everything to make them thought formidable. It is difficult to find a more beautiful programme for a military architect; thus the keeps among the edifices of the middle ages are frequentln masterpieces of foresight. We have found in these structures, little known or imperfectly studied, arrangements demanding careful examination, because they bring to light one of the sides of feudal life.[1]

Note 1.p.36. So far, men have scarcely occupied themselves in the archaeological world except with religious or civil a architecture; yet feudal architectsre, of which the keep is the most striking expression, in our opinion is superior to all that the art of the constructor produced in the middle ages.

The first reason that caused the erection of keeps was the Norman invasion. The Merovingian villas must strongly resemble the Roman villas; but when the Normans threw themselves p periodically on the western continent, the nobles, monasteries, kings and cities themselves thought of protecting their domains by a sort of wooden blockhouse erected on the banks of r rivers and as much as possible on sites already defended by n nature. These fortresses into which at need were brought in haste all precious possessions, commanded entrenchments more or less extended, composed of a ridge crowned by a palisade

and protected by a ditch. The Normans themselves, when they had adopted the habit of landing on the coasts of Gaul and ascending rivers, established on some islands near their mouths, or on promontories, entrenched camps with a firtress, to protect their booty from attacks and their moored vessels. Thus in provinces especially ravaged by the Normans are found the oldest keeps, and these primitive fortresses are usually built on a rectangular plan forming a parallelogram sometimes divided into two parts.

At many poents on the banks of the Seine, Loire, Eure, and on the coasts of the East and West, are found remains of these primitive keeps; but these structures were profoundly modified after the epoch in which they were erected, and only show substructures often incomplete. It appears that the first keeps, built of masonry according to a nearly uniform system, were built by the Normans when they were definitely established on the continent (Art. Chateau), one of the best preserved among these keeps is that of the castle of Arques near Dieppe, erected about 1040 by William, uncle of William the Bastard, In saying that the keep of Arques is one of the best preserved, it must not be pelieved that an edifice will be found there, whose arrangement is easily seized at first sight. The keep of Arques was repaired in the 12 th century, appropriated for use by artillery in the 16 th century, mutilated after the revolution by the inhabitants of the village, who carried away all that they could, and presents at first sight only a ruin ravaged by time and men. It is necessary to examine these ruins with the most scrupulous care, trace the numerous turns of the passages and the habitations, to return twenty times to the site, in order to appreciate the intelligent efforts shown by the constructors in the combination of that fortress, in our opinion one of the most remarkable.

Let us first say a word of the structure. As in most military edifices of the Romanesque epoch, the construction is here according to the Roman method, i.e., it is composed of a concrete consisting of flints set in a bed of very hard and coarse mortar, faced with small cut stones 5.5 to 7.9 ins. high between beds by 7.9 to 12.6 ins. long. This facing is of freshwater limestone from the valley of Sie, of good quality though quite soft, but hardining in the air.[1] We must ask the

entire attention of our readers to follow us in the following description, that we shall make as clear as possible.

Note 1.p.37. This quality of stone was already employed by the Romans, and it is found in the antique theatre of Lillebonne. Since the 13 th century it has ceased to be quarried, we do not know why.

Fig. 1 gives the plan of the ground story of the keep of Arques, which is located near the south gate of the castle.(Art. Chateau, Fig. 4.). At A is the entrance with its flying bridge, its double defense A in the form of an internal turn, with w wide machicolations commanding the gate A. A long bent corridor leads into the internal court. At C was a little guard w without direct communication with the interior of the keep, but included in its perimeter. To enter the fortress it was necessary to turn to the left and reach the door D. That door passed, a stairs was found on the right with a second door E pierced through a buttress, then turning to the left a very long stairs E', direct and very steep. We shall return to this soon. Along the rampart of the castle at F, and masked externally by the battlemented gallery, one reached another very narrow door G, that admits ao a starrway containing a central stairs turning to the left, making a complete revolution and reaching the landing I, whence by a stair turning to the right in the thickness of the wall, one ascends to the second and third stories, as we shall see. The two lower halls J J had no direct communication with the exterior (the passage L having been opened in the 1_ th century) and not communicating with each other. One must descend into these two lower halls by stairs or ladders passing through openings arranged in the floor of the second story. These halls were actual cellars suitable for containing provisions. At K is a well more than 263 ft. deep with masonry wall up to the floor of the third story. Do not omit to note the stairs M cut in the rock (chalk) and descending by a rapid inclination to the bottom of the external ditch. Let us also mention the stairs N, that passes over the entrance corridor B; its utility will soon be demonstrated.

Let us see the plan of the second storn (2). One can only r reach this story by the screw stairs O extended from this second story to the third, i.e., it was necessary to descend to the second story after having ascended to the third, or indeed

taking the stairs N (just mentioned) passing through the tower commanding the entrance B, ascending a step and turning to the right in the narrow passage with steps, one entered the ande hall P, and from thence penetrated into one of the halls J′ of the second story of the keep. As for the hall J″, it was necessary to reach it by passing through a trapdoor arranged in the floor of the third story. All that is very complex; bu but yet this nothing more. Let us endeavor to remember these various exits, and not lose the trace of these stairs and corridors, an actual labyrinth.

Arriving at the third story (3). There again exists the unbroken partition wall, forbidding all communication between the two halls of the keep. Resume the great stairway E′, just abandoned; it reaches a landing on which at the left opens a door directly entering the hall J‴. But it is not necessary to believe it easy to ascend that long stairs; first on the right and left exist two walks on a level with the upper landing, that allowed the numerous defenders to crush the assailants ascending this long stairs; then several machicolations opened in the upper floor of that stairs dropped a rain of s stones, beams and boiling water on the assailants. From the hall with stairs with a full turn, that we have seen at the right in the plans of the ground a second stairs, by the bent stairs in the thickness of the wall, one reaches the corridor S, which by a door admits to the hall J‴. Hence if by surprise or otherwise an enemy succeeded in passing the stairs E′, the defenders could pass through the corridor S, steal away, descend by the stairs I (plan of ground story), leave by the door G, seek the postern M communicating with the ditch; or - again ascend by the stair N, the tower B (plan of second story), reenter the hall J′ by the ante hall P, take the screw stairs and join the portion of the garrison still occupying half the keep. On the contrary, if the assailants by sap or scaling (which was scarcely possible) took possession of the hall J‴ (plan of third story, Fig. 3), the defenders could s still steal away by leaving the ante hall P′ and descending the stairs T′ as we have seen, communicating either with the hall J′ of the second story, or with the stairs N. Or again the defenders could again ascend or descend the screw stairs O, passing through the cabinet V. From the landing T one des-

descended to the terrace U commended by slots pierced in the corridors S S′.

From all this it may be admitted already, that the garrison of the keep was double in two stories (second and third); that these two parts of the garrison had no direct communication w with each other, that to establish this communication, it wa s necessary to ascend to the fourth story occupied by the commander, and that consequently if one side of the keep were taken, the garrison could assemble in the upper part, resume the offensive, crush the assailants lost in the midst of the labyrinth of passages and stairs, to regain the portion aleeady lost.

The fourth story (4) is entirely destroyed, and we can only have an idea of it by the drawings of 1708, reproduced in the work of M. Deville.[1] These drawings indicate machicolations that still existed at that time in the upper part, and the g general arrangement of that story, converted into a platform after the 15 th century to place artillery. M. Deville did n not seem to recognize the age of the vaults which still covered the third story in 1708. Yet sections of the ribs of those vaults (5) sufficiently show that they belong to the restorations of the end of the 15 th century. Primitively the stories of the keep, conformably to the Norman method, were only separated by wooden floors, traces of which are found on the internal surfaces. The plan of the platform given in the drawings of 1708 shows sufficiently that the partition wall no longer existed in the fourth story. Indeed from that story the command must be exercised and the defense be organized with unity.

Note 1.p.41. Hist. du chat. d'Arques. Rouen. 1839.

Then this plan (Fig. 4) indicates a single hall X with anc central post designed to relieve the upper carpentry; a cabinet Y, that might serve for a chamber for the commandant; the machicolations pierced in the chamber Z above the great flight of stairs; the two macricolationr a a reached by the two openings b b, the defensive passage c c, made in the thickness of the wall above the arches of these machicolations, and the machilocations at the angles d d. In this plan is also seen the defense of the gallery e, that commands the outside and allows one to see what passed in the ditch beside the gate. At f is a fireplace and an oven at h, for the keep contained a mill (probably for hands). On the arrangement of the upper

story we possess only very vague data, since in 1708 that story was destriyed; we only see in an account of repairs from 1355 to 1380,[1] that turrets covered with lead terminated that story; these turrets must be closed to shelter the defenders, such as still exist at the top of the keep of Chamboise,[2]. T The plan of that story, that we give (6), indicates two turrets at l l′; the turret l′ showing its machicolations i over the flight of the grand stairs, further at m are perceived t the openings of other machicolations commanding the reentrants of the buttresses. This m′ opens on the lower flight of the great stairs, showing the simple uncovered guard wall, traced at D in the plan of the ground story. Fig. 1.

Note 1.p.42. Mansucript in Imp. Library.

Note 2.p.42. See this keep later. Fig. 1.

Fig. A presentr the facade of the keep of Arques next the c court. At A is the opening of the great corridor of the external gate, at B is the entrance of the stairs of the keep. The other parts of this Fig. explain themselves by examination of the plans.

Fig. 8 gives the section of the structure on the broken line A A, B B of the plans. At C is the little guard room traced at l on the plan of the ground story, at D is the screw stairs situated under the great flight whose landing is at E; at F is seen the machicolations commending the landing. Today the structure does not rise above the level G; in 1708 it existed to the level H, and the extrados of the vaults built in the 15 th century did not exceed this level; so that the walls b between G and H served as parapets and openings of embrasures for cannon. The guns leveled on that platform contributed , by firing on the duke of Manenne, to the success of the battle gained by Henry IV in the valley of Arques.

Fig. 9 traces the section of the keep on the line C C, D D of the plans. At A is detached from the principal body the buttress serving as a traverse to see the bottom of the ditch a and command it from the top of the keep. At B is cut the corridor at the level of the third story, which commands the defensive gallery D and the terrace Ca At C are visible the great machicolations with the upper defense in two stories made at the expense of the walls over the arches.

The section (10) made on the line E E, F F of the plan per-

permits the understanding of the ingenious combination of the stairs. At A is profiled the great flight reaching the third story with the upper machilocations, which command its last steps and landing. At R is seen one of the two side platforms arranged to receive the defenders of the stairs and to crush the assailants. At D appears the trace of the narrow inner s steps leading to the corridor S indicated on the plan of the third story, and which permits the defenders to disarm or to leave by the screw stairs B. At C is a false landing, that commands the turns of the stairs B.

The castle of Arques is admirably located, surrounded by w wide and deep ditches commanded by the keep of this importance, and must have been an impregnable place before artillery. Scarcely built, it was soon besieged by William the Conqueror, and was only taken by famine after a long blockade. Repaired and rebuilt in part by Henry I in 1123, it was besieged by Geoffrey Plantagenet, who could enter it only after the death of its commandant, William Lemoine, slain by an arrow, that siege lasted an entire year, 1145. Philip August invested the castle of Arques in 1202, and soon raised the siege on the news of the captivity of the young Arthur of Brittany, fallen into the hands of John Lackland. The keep of Arques was the last fortress to surrender to the king of France, after the conquest of Normandy from the hands of John Lackland. Henry I as we have said, caused the execution of considerable works at the castle of Arques; but the examination of the existing structures cannot cause it to be supposed, that the great work of the keep belongs to that epoch. Perhaps Henry restored the upper parts that no longer exist, perhaps even the great machicolations of the facade (Fig. 7) date from the reign of that prince, for the arches of the machicolations, that we see represented as round, are pointed arches on the drawing of 1708, also drawn incorrectly, because it does not indicate accurately the parts of the structure, that we have seeu still standing. As for the general arrangement, the system of corridors and stairs, with a little care one can perfectly recognize their traces, and in that keep of Arques, that was taken by storm, is a military structure of the highest interest, a and in spite of its ruinous state, is much more complete from the point of view of defense, than are the celebrated keeps

of Locnes, Montricnard and Beaugency, constructed on nearly tne same metnod. What especially makes tne keep of Arques a complete type of its location in the plam of that castle; protected by tne curtains of that place and two rivers, it still commands the exterior; it possesses its well defended gate for outside arsestance; it protects the enclosure, but also can batter it successfully in case of need; it is absolutely not to be attacked by sap, the sole means tnen employed for overthrowing walls; it permits receiving and maintaining an uncertain garrison, for its defenders can only act blindly, and at tne point assigned tnem. Treason or surprise would not be practicable, since if a part of the keep were taken, it would be eary for some determined mem to cut the communications, to enclose the assailants and crush them before they could be recognized. As a last resource, tne commandant and his devoted men could still escape. Fire alone could destroy the fortress; but when one considers the width of the ditches of the castle cut at the top of a hill, the neignt of the walls, the absence of external openings, it is not intelligible how an assailant could have nave cast incendiary materials on the roofs, the more that it was difficult for him to establish at a suitable distance to cause nis casting macnines to act successfully.

The Norman keeps and tne Romanesque keeps in general were built on a rectangular plan, a fortified nabitation, the dwelling of tne lord; they contained cellars for provisions, a chapel, halls witn cabinet, and always at the top a great free area for easily organizing the defense. Most of these rectangular residences possessed their principal stairway separated from tne body of tne structure, and sometimes this partition wall dividing tnem into two equal parts. The entrance is habitually placed mucn above the ground at the level of tne second story. One can enter tne keep only by a ladder or by means of a movable bridge witn a wooden stairs, that was destroyed in time of war.

The little keep of Chambois, that dates from the 12 th century, presen s most of these arrangements in detali. Its plan is rectangular with four square buttresses at the angles. A square tower placed at one side contained originally little closets and the wooden stairs crowned by a defense, and ascending only to tne fourtn storw. The defense at top was reached

by a screw stairs placed in one of the angle buttresses. The upper parts of the keep were rebuilt in the 14 th century and according to the system of defense of that epoch; but from the first arrangement still remains three stories and an extremely curious defensive gallery. The plan of the keep of Chambois is given here by Fig. 11. One sees at A the square turret attached to the body of the structure, and in which in the 14 th c century was made a screw stairs. This keep was not vaulted, no more than most Norman keeps, the stories were separated by w wooden floors supported on internal corbels. Its doorway is r raised 19.7 ft. above the ground, and opens at the side of t the square turret containing the wooden stairs; one could reach that doorway, whose threshold is at the level of the floor of the second story, only by means of a ladder, and the keep was defended in its lower part only by the thickness of its walls. At the beginning of the 14 th century the old buttresses were replaced by a parapet with machicolations, battlements and s slots. On the four angle buttresses were beautiful turrets with battlements on the upper story, probably in the place o of the old flanking turrets.

Here (12) is the elevation of the keep of Chambois on the side of the little square tower before the construction of the buttresses of the 14 th century. The building of the 12 th century rises intact today to the level B; at the level C opens the postern. But the most singular peculiarity of the keep of Chambois consists in the upper defensive gallery, which below the buttress places the four turrets of the little attached tower in communication with each other, without its being necessary to pass into the central hall occupied by the commandant. Thus the defense was entirely independent of the habitation, and it occupied two storier, one covered and the other uncovered. Here in section (13) is the arrangement of this covered defensive gallery, that extends around the keep and connects the turrets below the buttresses. This defensive gallery still exists nearly complete. The keep is constructed of rubble connected by excellent mortar, the angle buttresses are built of small cut stones, as well as the enclosures of the openings.

Rectangular keeps like those of Arques, Loches, Beaugency, Domfront, Falaise, Broue, Nogent le-Retrou, Montrichard, Mont-

Montbazon, Chasvigny, Blanzac, Pouzanges, which were all erected under Norman influence during the 11 th and 12 th centuries, were rarely more than passive defenses, guarding themselves rather by their mass, by the thickness of their walls and the difficulty of access, than by defenses properly so called. These were excellent retreats, when it was only necessary to protect them against troops armed only with bows and crossbows, possessing some imperfect machines, and only being able to resort to sap as the last recourse. But if from the interiors of these residences men scorned assailants equipped with war machines of weak power, neither could they cause them serious losses. Besieged lords only had to watch over their men, make frequent rounds, assure themselves that the gates were closed, to cast some projectiles from the battlements if the assailants attempted to approach the walls, to countermine if they mined; and further they could remain thus for entire months w with nothing to fear, even before a great army. Thus it was almost always by famine that fortresses were taken. But when the art of attack was perfected after the first crusades, when besiegers placed powerful engines in battery, branched trenches were made, long covered wagons were employed, those cats, to allow sapping the walls without danger to the miners, then the rectangular keeps, however thick the walls, appeared insufficient; their angles were not flanked and offered salient points that the miner attacked without great danger; the garrisons shut up in these fortresses saw with difficulty what p passed outside, they could not attempt sorties by those doors placed several yards above the ground; the complication of d defenses was a cause of disorder at a pressing moment; the besieged themselves wandered or lost much time in the midst of those numerous bends, or were even caught in the snares placed by them selves. From the middle of the 12 th century, these defects of the defense of the Norman keep were certainly recognized, for the system was completely changed, and they abandoned at once the rectangular form. One of the first and happiest attempts toward a new system is seen at Etampes. The keep of the castle of Etampes, although very ruinous, still possesses more than three stories, and one can take account of various details of its defense. We cannot assign this structure a date before 1150 nor later than 1170. Some capitals s

that still exist and the mode of building belong to the last time of the Romanesque epoch, but still cannot date from the reign of Philip August. Tradition carries the construction of the keep of Etampes back to the beginning of the 11 th century, which is not admissible. Philip August shut up his wife Isburge in 1199 in the keep, that we still see today;[1] then it existed before that epoch. The capital drawn here (14) can leave no doubt concerning the date of that fortress; it is i indeed the sculpture of the beginning of the second half of the 12 th century.

Note 1.p.51. Dom Fleureau. See the note on the keep of Etampes inserted in Volume 12 of Bull. Mon., p.468 by M. Petit.

The plan of the keep of Etampes is a quatrefoil, which gives a better flanking than a cylindrical tower. It is placed at the end of a plateau dominating the city of Etampes, above the railway station. The defenses of the castle formerly extended far on the plateau toward the west and south; so on the western side this keep was protected by a guard wall, whose substructure is still visible. This wall (15) probably returned at the south, ending at a sort of diagonal road A′ designed to receive the end of the drawbridge, that permitted entrance to the tower by a postern placed below the level of t the second story. The ground story was roughly vaulted with rubble, and these vaults rested on a great central column, t that extended to the second story. It was necessary to descend from the second story to the level of the ground story by a stairs B, made in the thickness of the wall, which is not less than 13.1 ft. At C is a well and at D the pit of the privy. F from the vestibule E of the postern, turning to the left, one then descended by the flight B to the lower story, turning to the right, one ascended by several steps to the level of the second story. Thus the vestibule E was placed at the middle of the story, so that the assailant entering abruptly by the postern and goint straight forward fell from a height of at least 13.1 ft. to the floor of the cellar, where he found himself shut up; the defenders posted on the stairs ascending on the right must further push him into that open pit. The right flight then reached the level of the second story (16) at G; from there one entered the hall through the opening of the window. But if one desired to ascend to the third story, it

was necessary to enter the little guard room H, placed just
[illegible]
tion, take the stairs I leading to a screw stairs serving the
[illegible]
rd story was placed over the court G. The curb of the well C
was placed on the vaults of the ground story, then from the
second story was drawn the water necessary for the needs of
the garrison. At D is seen a privy. The second story was ori-
ginally covered by a floor, whose principal beams rested on
the central column, according to the dotted lines. About the
middle of the 15 th century, this floor was replaced by vaul-
ts. The groin lines of these vaults, the corbels supporting
them, and the manner in which they were inserted later in the
structure, are certain signs of the restoration, that has mod-
ified the primitive arrangements of the keep of Étampes. The
little guard room H placed over the postern, probably contai-
ned the mechanism intended to work the drawbridge ending on
the road A'.

The third story (17) was designed for the residence of the
lord. It is furnished with two fireplaces C and has privies
at L. At P is seen the landing of the stairs in a window open-
ing with floor placed a little below the main floor. Four en-
[illegible]
utility is at once recognized; further, two other transverse
arches are turned at P to bear the central roof. The screw s
stairs continues and reaches the level of the fourth story w
with battlements and arranged for defense. The roof consists
of a square hip roof intersected by conical roofs. Now assume
(17) a section made on the line A B of the plans. We see at F
the false internal entrance cleared at the level of the floor
of the postern and falling into the cellar. at F' is the fli-
ght descending to the floor of that cellar along the well; at
G is the landing of the flight at the level of the second sto-
ry; at H is the door opening into the guard room located over
the vestibule of the postern and in the stairway, partly a s
screw, whose first exit is seen at I at some places below the
floor of the third story. Continuing to ascend this screw st-
airs, one reaches the door V, pierced at the level of the fl-
oor of the fourth story, above the great hall, a story entire-
ly intended for defense. But that the defenders could easily

was necessary to enter the little guard room H, placed just over the vestibule of the postern and pierced by a machicolation, take the stairs I leading to a screw stairs serving the third and upper stories; the landing at the level of the third story was placed over the point G. The curb of the well C was placed on the vaults of the ground story, then from the second story was drawn the water necessary for the needs of the garrison. At L is seen a privy. The second story was originally covered by a floor, whose principal beams rested on the central column, according to the dotted lines. About the middle of the 15 th century, this floor was replaced by vaults. The groin lines of these vaults, the corbels supporting them, and the manner in which they were inserted later in the structure, are certain signs of the restoration, that has modified the primitive arrangements of the keep of Etampes. The little guard room H placed over the postern, probably contained the mechanism intended to work the drawbridge ending on the road A′.

The third story (17) was designed for the residence of the lord. It is furnished with two fireplaces O and has privies at L. At G is seen the landing of the stairs in a window opening with floor placed a little below the main floor. Four engaged columns bear two great diagonal transverse arches, whose utility is at once recognized; further, two other traysverse arches are turned at P to bear the central roof. The screw s stairs continues anf reaches the level of the fourth story w with battlements and arranged for defense. The roof consists of a square hip roof intersected by conical roofs. Now assume (18) a section made on the line A B of the plans. We see at F the false internal entrance pierced at the level of the floor of the postern and falling into the cellar. at B′ is the flight descending to the floor of that cellar along the well; at G is the landing of the flight at the level of the second story; at H is the door opening into the guard room located over the vestibule of the postern and in the stairway, partly a s screw, whose first exit is seen at G at some steps below the floor of the third story. Continuing to ascend this screw stairs, one reaches the door M, pierced at the level of the floor of the fourth story, above the great hall, a story entirely intended for defense. But that the defenders could easily

receive the orders of the commandant living in the great hall, or to promptly inform him of what was passing outside, a sort of galleries had been established at mid-height of that hall in the four lobes formed by the quatrefoil, galleries to which one descended by trap ladders passing through the floor of the fourth story as indicated by the plan of the upper part (19). That arrangement had also the advantage of allowing the entire garrison to gather in the great hall without crowding, and of promptly sending the defenders to the battlements. There are found in place today the fastenings of the principal beams of these four galleries, the corbels that received the anchors, the springings of the transverse diagonal arches and the arches parallel to the walls they supported; the upper openings are preserved for about half their height. The plan (Fig. 19) shows that the upper part was entirely free, only traversed by the walls resting on the two transverse arches marked P on the plan of the third story, walls pierced by openings and intended to support the central roof. The two great diagonal t transverse arches supported the floor and the kingpost of the roof. Indeed this floor, on which it was necessary to place in reserve a considerable store of projectiles, and that had to resist the movements of the defenders, must present great stability. It was they necessary for the beams to be relieved in their spans; the diagonal arches perfectly fulfilled that office. The upper story was pierced by numpeous openings, as indicated by a perspective engraved by Chastillon, and must be equipped with defensive galleries in time of siege, according to the defensive system of that epoch. These defensive galleries, shown in plan (Fig. 19), are found at S on one of the lobes of the tower in external elevation (20). That elevation is taken on the side of the postern. The upper structure above the level V of the layer exist today; but although this keep is very ruinous,[1] yet all its internal arrangements are perfectly visible, and explain themselves with a little a attention in their examination. The building is well done; t the jambs of the windows, arches, piers and angles ane of cut stone; the rest of the masonry is of rubble connected by excellent mortar. The keep of Etampes must have been a powerful defense for that epoch, also very habitable, if could contain a numerous garrison relatively to the area occupied.

Note 1. p.57. Known under the name of the Tower of Guinette.

The keeps are certainly of all military structures those e explaining most clearly the kind of life, customs and manners of the feudal nobles of the middle ages. The feudal lord retained something of the Frankish chief, he lived in his habitation in the midst of his companions in arms; but still one already perceives after the 12 th century, that he sought to isolate and separate himself and his family from his garrison; one feels mistrust everywhere within and without the fortress. At night the keys of the keep and even those of the castle were brought to the lord, who placed them under his pillow.[1] As we have seen and shall see, the actual keep was approached from outside; it even possessed secret exits independent of those of the castle, to escape or make sorties into the country; i its lower stories were well walled and intended for provisions; its intermediate stories contained a chapel and the habitation; its top served for defense; there is always found a well, fireplaces and even ovens. Besides, the keeps present very varied arrangements, and that variety indicates in particular the attention devoted by the nobles to the construction of such important a part of their castles. It is evident that each lord desired to embarras assailants by novel defensive combinations belonging to him alone. Dating from the 12 th century one notes a singular diversity in these fortified residences; as many keeps in France, so many examples. We shall select among these examples those presenting most interest from the point of view of the defense, for it would exceed the limits imposed on us in this work to give all.

Note 1.p.58. "If the night came that he must give them, he went (the chamberlain) to take the keys beneath the pillow of Gerard, who slept with madale Bertha in his keep, and opened the gate of the castle to the king of the French." (Gerard de Roussillon. Edito of Lyons).1856).

Suger [2] says some words of the castle of Roche-Guyon, with regard to the traason of William, brother-in-law of the king, toward his son-in-law Guy. "On the promontory, that forms in a place of difficult access the bank of the great river Seine, is built a castle of a noble but frightful appearance, named Roche-Guyon; invisible externally, it is excavated in a high rock; the skilful hand of its constructor has cut the rock

itself on the slope of the mountain by the aid of a narrow a and mean opening, and formed underground a habitation of very vast extent. Formerly, according to the general opinion, either a prophetic cavery where were received the oracles of Apollo, or the place of which Lucan says:- (Latin poem). Here one descends to the infernal regions."

Note 2.p.38. Vie de Louis le Gros. Chap. 16. mem. rel. . l' hist. de France, translated by M. Guizot.

Suger speaks thus of the castle whose remains we see today. The subterranean rooms cut in the rock still exist, and if t they are not ancient caverns, if they do not descend to the i infernal regions, they date from a very distant epoch. Yet t the lodgings were not excavated in the cliff as Suger claims, but are built against a precipice of chalk cut by human hands. (Art. chateau, Figs. 8, 9). The castle of Roche-Guyon is in our days almost unrecognizable because of the changes it has suffered, one finds again there some traces of structures of the 12 th century; as for the keep, it is entirely preserved excepting its top, and its construction appears to belong to the meddle of that century.

Fig. 21 gives at A the location of the castle of Roche-Guyon. By a drawbridge B communicating with the upper stories of the castle, one reaches the platform C cut in the hill leveled at the peak; that platform gives entrance to a first ascending subterranean stairway, which lands at a second platform D in the open air. An excavation E intercepts all communication w with a third platform F. A wooden bridge, that could be destroyed in case of attack, alone permitted one to reach that t third platform. Thence by a long subterranean stairway with steps cut in the chalk and flint are not less than 11.8 to 15.7 ins. high, one arrived at G within the second enclosure of t the keep, built on the slope of the precipice. At K is traced the section of that subterranean stairs. It was absolutely i impossible to force a similar entrance, and the assailant, th a that had possessed himself of the castle, would have been easily crushed by the garrison of the keep. Let us now see how were arranged the defenses of the keep proper, placed in an exceptional position at Roche-Guyon.

Here (22) is the plan of the ground story of that keep. At A ends the subterranean passage; beside it is placed privies

in the thickness of the outer wall. A little post commands t the lower opening of the down flue from these privies. From t the entrance A to ascend to the keep, it is necessary to turn abruptly to the right and aslend the steps B, which land at t the postern C. At the left is found the screw stairs serving the upper stories. The landing before the postern outside was of wood, as well as the bridge B leading to the defensive gallery E, commanding the precipice. At F is a well, at S a little pit for preserving salted provisions.[1] From the internal enclosure of the keep one reached the outer enclosure by two posterns G G′, which are intact. Passing over an excavation F the besieged could pass outside by the outer postern H, perfectly defended by the two parapets intersecting at a right a angle. At I in a very recent epoch was pierced a second outer postern; but primitively the tower I was solid and formed a thick projection, defendable at the side where the assailant must direct his attack. A ditch cut in the rock surrounded t the first enclosure, and a system of palisades and trenches connected the keep tn an advanced work indicated in Figs. 8 and 9 of Art. Chateau. If we cut the keep longitudinally on the line O X, we obtain Fig. 23.

Note 1.p.60. In that little excavation the stones are deeply permeated by salt.

In this section one sees how the two curtains outside the principal tower rise in following the slope of the plateau to command the exterior on the side that can be attacked, how these curtains of the tower itself form projections at that side. From the principal tower the garrison passes into the defensive gallery of the second curtain by means of the drawbridge indicated at D on the plan; by a series of steps it arrives at the highest point R. Bw doors arranged in the parapet of this second enclosure, it passes to the defensive gallery of the first wall, whose highest point is at T. An assailant could not think of attacking the keep at the two sides M and N. (Plan in Fig. 22). He must necessarily direct his principal attack to the top at the angle I; but there if he wished to scale the ramparts, he would find behind the parapets the defenders massed on a wide platform; if he wished to employ the method of sap, he would meet with an enormous mass of rock a and masonry. Admitting that he could penetrate the first and

the second enclosures, it would be difficult for him to ascend [illegible] find himself exposed to projectiles cast from the tops of the defensive galleries of the first and second curtains. The same difficulties would be found if he desired to pierce this second curtain. If he succeeded in passing it, it would be impossible to maintain himself and to set in the narrow space left between the second curtain and the tower. There was no other way of getting possession of this keep, than by proceeding by a subterranean mine from the point I to the point S; now one understands that such an enterprise would be long and difficult in execution, the more so that the besieged could easily countermine between the two curtains and destroy the works of the besiegers.

The side elevation (24) indicates the slope of that platform of basalt, its escarpments made by hand of man, the position of the subterranean works communicating with the castle and the different heights of the parapets of the two curtains, as well as the commanding by the principal tower. All in that structure is entirely without ornaments, and is profoundly calculated from the point of view of the defense. The [illegible] of the walls of the two curtains, as these walls become higher and approach the point, that can be attacked, the arrangement of the projections intended to resist sap, and to receive a considerable number of defenders at the extremity of the salient opposite the northwest part of the plateau, the manner in which the doorways are arranged so as to be masked from the assailants, all this is very judiciously conceived and executed with care. Here the rule that "what defends must be defended," is carefully observed. The structures are well built in rubble, with ledges, angles and jambs in cut stone. In this is not a moulding, not a useless stroke of the chisel; he that ordered it and he who executed it have only had the thought of erecting an impregnable post on this promontory; today a [illegible]

It is certain that the feudal lords who inhabited these residences had little taste of neatness, when they were obliged to shut themselves up there (which frequently happened); so one should not be surprised if at the end of the 11th and 12 [illegible]

the second enclosures, it would be difficult for him to ascend to the defensive gallery of the external curtain, and he would find himself exposed to projectiles cast from the tops of the defensive galleries of the first and second curtains. The same difficulties would be found if he desired to pierce this second curtain. If he succeeded in passing it, it would be impossible to maintain himself and to act in the narrow space left between the second curtain and the tower. There was no other way nf getting possession of this keep, than by proceeding by a subterranean mine from the point I to the point S; now one understands that such an enterprise would be long and difficult in execution, the more so that the besieged could e easily countermine between the two curtains and destroy the works of the besiegers.

The side elevation (24) indicates the slope of that plateau of chalk, its precipice made by hand of man, the position of the subterranean works communicating with the castle and the different heights of the parapets of the two curtains, as well as the commanding by the principal tower. All in that structure is entirely without ornaments, and is profoundly calculated from the point of view of the defense. The reinforcement of the wallu of the two custains, as these walls become higher and approach the point, that can be attacked, the arrangement of the projections intended to resist sap, and to receive a considerable number of defenders at the extremity of the salient opposite the dominant part of the plateau, the manner in which the posterns are arranged so as to be masked from the assailants, all that is very sagaciously conceived and executed with care. Here the rule that "what defends must be defended," is perfectly observed. The structures are well built in rubble, with deges, arches and jambs in cut stone. In this is not a moulding, not a useless stroke of the chisel; he that o ordered it and he who executed it have only had the thought of erecting an impregnable post on this promontory; modern a artillery alone could subdue that little fortress.

It is certain that the feudal lords who inhabited these residences must die there of weariness, when they were obliged to shut themselves up there (which frequently happened); so o one should not be surprised if at the end of the 11 th and d during the 12 th centuries, they hastened to take the cross

and to risk adventures in the Holy Land. During the long hours of leisure left, to a lord shut within one of these gloomy keeps, hatred and mistrust must germinate and develop without ogstacles; but also in properly formed souls, generous and matured resolutions with elevated thoughts must appear; for if solitude be dangerous for weak minds, it develops and enlarges hearts well born. Indeed from the depths of gloomy keeps have c come those principles of chivalry, that have taken so great a part in the history of our country, and which in spite of faults, have contributed to ensure its greatness. Let us respect these ruins; if they recall odious abuses and even crimes, they retain the impress of the moral energy of which we still possess the tradition.

There still exists at Provins a keep built on the highest point of that city, so curious for the quantity of public and private edifices that it contains; this is the tower called Tower of Cesar, Tour-le-Roi or Notre-Sire-le-Roi. It is an actual keep from which were held most of the fiefs of the domain of Provins, and that was built about the middle of the 12 th century. The keep of Provins presents in plan an octagon with four sides smaller than the other four, the smaller sides being flanked by turrets engaged at their bases, but detached from the body of the structure in their upper part, thus permitting fighting all around. This keep could be furnished with a great number of defenders, because the different receding stories and the flanking position of the turrets.

Here (25) is the plan of the ground story of that keep, whose base was terraced in the 15 th century by the English, p probably to receive cannon. At C is seen the place occupied by that terrace. At P is a well to which one descends by stairs with entrance at F. At G is the oven established in the 15 th century; at H, the old chapel.

Fig. 26 gives the plan of the second story of this keep; it is only at the level of that story that one finds four posterns I communicating with the external curtain by means of drawbrodges. At the south side one of these drawbridges falling on a bent causeway, corresponding to the prolongation D of t the wall ending at the Paris gate, placing the parapet of the curtain in communication with the defensive gallery of this rampart. By the screw stairs K one ascends to the upper defen-

defensive galleries independent of the building. It is necessary to descend from the second story to the ground story, w which has no communication with the outside. In the thickness of the wall of the ground story is found quite a large dungeon, that is said to have served as a prison for John the Good, duke of Brittany. The second story presents a great number of cabinets, separate rooms suitable for lodging the chiefs. From the second story by four posterns I, one could easily pass to the defensive gallery of the curtain, now terraced.

The theird story (27) shows at K the landing of the screw stairs; at L are the defensive galleries with battlements reached by the little double stairs N; at Mare the four flanking turrets. Here as at Chambois a defensive gallery with tunnel vault is found below the upper battlements.

The section (28) made on the line A B of the plans of the ground and second stories, indicates the descent to the well, the posterns pierced at different levels, that on the right being the principal (because pierced opposite the road of arrival), not being in direct communication with the enternal h hall of the second story. At mid-height of the second story a are seen battlements defending the four principal facades; th then at the height of the third story is the defensive gallery with tunnel vault and the upper battlements, whose parapet is furnished with projecting defensive galleries projecting beyond the turrets. Today the structure is nearly destroyed above the level X X. The position of the wooden galleries of the four upper fronts does not seem doubtful; one cannot otherwise explain the recession arranged above the defensive gallery of the mezzanine, a recession that appears intended to support the feet of the great struts of these defensive galleries, s projecting sufficiently to form machicolations outside the u upper gallery. These galleries being thus arranged, flank the turrets, that themselves flank the fronts.

An external elevation (29), assuming the curtain wall cut on the line R S of the plan, Fig. 26, explains the arrangement of the posterns with the drawbridges Q, as well as the stories of superposed defenses with the wooden galleries. The keep of Provins is built with great care. In the 16 th century these drawbridges existed no longer, the curtain wall razed and terraced left the sills of the posterns several yards above the

level of the platform, and men only entered the keep by ladders.[1] The groond and second stories, as shown by the section (Fig. 28), are vaulted, the upper vault being pierced by a r round opening to permit easy hoisting of projectiles to the upper defensive galleries, and to give orders from the top to the men posted in the hall of the second story.

Note 1.p.68. See the excellent work of M. Felix Bourquelot on Hist. de Provins. Provins. 1839. Vo.. I. p. 305 et seq.

The principal defect of these fortresses , transferring one's self even to the time when they were built, is the complication of the defensive means, the narrowness of the passages, those multiplied arrangements of details, those tricks that in the moment of defense injured it, and prevented acting with vigor and promptness at the point attacked. These keeps of the 11 th and 12 th centuries are rather made to guarantee t them from surprise and treason thau against a strong attack directed by a bold and persevering captaio. From these narrow tops, encumbered, men defended themselves badly. At the moment of a pretty hot alarm, the defenders even by their haste interfered with each other, encumbered the defensive galleries, and strayed in the numerous turns of the fortress. Thus when princes became sufficiently powerful to take in the campaign armies tolerably organized, numerous and acting with some unity, these Romanesque keeps could only defend themselves by their mass. Their garrisons were reduced to almost a p passive part, and could not do much injury to assailants well covered by mantlets and galleries, proceeding with system and already employing machines of a certain power. Philip August and his terrible adversary, Richard Lionheart, both great takers of places, tenacious in attack, possessing armed corps f filled with confidence in the valor of their chiefs, excellent engineers for their time, produced an actual revolution in the art of fortifying places and particularly keeps. Both felt the uselessness and even danger, from the point of view of the defense, of those prodigious bends in the last Romanesque fortresses. We have endeavored to emphasize the importance of the citadel of Andelyu and castle Gaillard, built under the direction and the eyes of Richard;[1] the keep of that fortress is for the time a work entirely remarkable. Richard first replaced the wooden defensive galleries and battlements by mach-

macnicolations of stone, conceived in a manner to entirely sweep the foot of the fortification on the side that could be attacked.

Note 1.p.69. Art. Chateau, Figs 11, 14.

The perspective (30) of the keep of castle Gaillard, taken from the side of the postern, explains the wise arrangement of these machicolations, composed of arches borne on buttresses wider at top than base, and springing from a pronounced slope suitable to cause projectiles to rebound, when dropped through the wide openings left between these arches of the face of the wall. The plan (31) of this keep, taken at the level of t the postern, which opens at the second story, shows the arrangement od this postern P with its slot sweeping the very steep steps leading to it, and the wide machicolations above it; the windows opened toward the precipice, the projection A strengthening the tower at the side attacked, and forcing the a assailant to show himself; the front B developed opposite the gate of the castle. The steps C landed at a postern of very difficult access placed on the precipice, and opening into t the enclosure well flanked as described in Art. Chateau, Fig. 11. The keep, whose foot is intirely plain and consequently protected from sap, is composed of a circular hall in the ground story, to which one must descend, and a second story at the level of the postern P, a third story at the level of the machicolations with the defensive gallery and battlements, a fourth receding story, enclosed and suitable for a store of projectiles, and a fifth story with battlements and covered, commanding the defensive gallery and the outside afar (Fig. 30). On the side of the abrupt precipice D, which dominates the course of the Seine (Fig. 31), the machicolations were useless, for it was not possible for assailants to present themselves at that point; hence Richard did not construct any- In the interior the different stories were in communication together only by wooden stairs passing through the floors. T Thus in this keep is nothing too much, useless or not absolutely necessary to the defense. This work in our opinion unveils in king Richard a military genius truly remarkable, a profound study of the means of attack employed in his time, a practical mind very far removed from the inconsiderate fury, t that modern historians attribute to that prince. Today these

structures are torn down to the height of the springing of t the machicolations at O.(Fig. 30).

However, this keep was taken by Philip August without the defenders, reduced to a small number, having time to take refuge in it; these defenses were therefore too restricted, and space was wanting; it must be stated that this tower must only be regarded as being the fortress of a very strong work, that served it as a curtain. The elevated doors of the Romanesque keeps, only to be reached by ladders or steps of difficult a access, in case of strong attack were a difficulty for the d defenders as well as the besiegers, if these defenders because of weakness of the garrison found themselves all compelled to descend to guard the exterior. But then as today, every was garrison not in accordance in number with the importance of the fortress was compromised, and these forts must retain their own garrison, sacrificing the defenders of the outer works, if those works were taken. At the taking of castle Gaillard, Roger de Lascy, who commanded for the king John Lackland, possessing only the remains of the garrison reduced by the s siege of eight months, had been compelled to go with all his men to the breach of the external curtain of the keep to defend it; his and himself were surrounded by the numerous soldiers of Philip August hastening to the assault, and could only make their way to that narrow stairs to the keep; Roger de Lascy was taken, and the keep fell into the hands of the conqueror at the same instant. It appears that this experience benefited Philip August, for when that prince built the keep of the Louvre, he opened it by a postern almost at the level of the external ground with a drawbridge and ditch. Of the ke-keep of the Louvre only remain very brief descriptions and v very imperfect representations, we only know that it was cylindrical, that its external diameter was 65.6 ft. and its height about 131.2 ft. Philip August seems to have regarded the cylindrical form as that best suited for these last defenses. If the keep of the Louvre no longer exists, that of the castle of Rouen, built by that prince, still remains, at least in great part, and gives us a diminutive of the celebrated tower of the Louvre, from which were held all the fiefs of France. That keep intercepted the curtain of the castle and had two entrances beside the inner surfaces of that curtain. These

entrances were raised but little above the soil and were in c communication with small isolated stairs, on top of which fell drawbridges.

Here (32) is the plan of the ground story of the keep of R Rouen. At A A′ are two posterns; B B′ are the curtain walls, whose attachments are still to be seen. Beside the screw stairs that ascends to the upper stories are privies, and at C is a well. This ground story and the second story (33) are va vaulted; the walls are nearly 13.1 ft. thick. Today (34) [1] this structure is torn down to the level D, and we have only insufficient data for restoring the upper portion. However o one must admit that this upper part comprised, according to c custom, a story under a floor and a story for defense with i its covered way and a defensive gallery supported on stone corbels. The keep of the castle of Rouen held two curtains by absolutely interrupting communication froc one covered way to the other, since no exit opendd from the interior of the keep into those covered ways. At the Louvre the keep was placed in the centre of a square court, entirely isolated, and did not command the outside in accordance with the ordinary rule. But the entire Louvre might be regarded as a vast keep, whose great central tower was the citadel. However the cylindrical form adopted by Philip August was evidently that best adapted to t that kind of defense, with regard to the means of attack of that epoch. That prince thought with reason that his enemies would employ for taking his castles the means that he himself had practised with success; for Philip August had had to make the siege of a great number of castles built according to the Norman system, and he could have recognized by experience, t that the angles of the towers and rectangular keeps always gave the advantage to the assailants. for these projecting angles were badly defended and perimtted the pioneers to attach themselves to their bases, to sap the foundations to the right and left, and to overthrow two sides of the wall. The cylindrical form gave no advantage at one point more than another, and admitting that the peineers could sap a segment of a circle, very extended excavations were necessary to cause a portion of the cylindrical wall to fall; further Philip August, as shown by the plan of the keep of the castle of Rouen, gave to the walls of his cylindrical keep an enormous thickness compa-

compared to their diameter. he spaced openings, rejected lower fllors of wood in order to avoidrisk of fire. This system prevailed during the course of the 13 th century.

Note 1.p.73. We owe these illustrations, plans, sections a oud elevations, to the courtesy of M. Barthelemy, diocesan a architect of Rouen.

The keep of the Louvre was scarcely erected and Philip August in the tomb, when the lord of Coucy, Enguerrand III, pretended to build a feudal castle, whose keep far surpassed in strength and extent the work of his sovereign. That colossal enterprise was conducted with prodigious activity, for the castle of Coucy and its keep, begun at once after the death of Philip August in 1223 were completed in 1230. (Arts. Chateau, Construction). The keep of Coucy is the most beautiful military structure of the middle ages existing in Europe, and happily it is preserved to us nearly intact. Beside that giant the largest known towers, either of France, Italy or Germany, are only mere spindles. Further, that beautiful tower gives us precious specimens of sculpture and painting of the beginning of the 13 th century applied to feudal residences. The plans already given of the castle of Coucy in Art. Chateau, Figs. 16, 17 a and 18, show clearly the site of that fortress, so that it w will be unnecessary to return here to that entirety of the m military structures. We shall exclusively occupy ourselves he here with the keep, referring our readers to the Article cited for the explanation of its surroundings, its curtains and defenses, its external exits and its excellent site, so well chosen to command the exterior of the fortress on the side m most easily attacked, to protect the defenses of the castle itself. The diameter of the enormous tower, not includiug the bottom slope, is about 100 ft. outside, its height from the bottom of the paved ditch to the top is 180.5 ft., not comprising the pinnacles.

Here (35) is the plan of the ground story of the keep of C Coucy. The postern is at A; this is the sengle entrance defended by a draubridge vere skilfully arranged (Art. Poterne) by machicolations, portcullis, barred roods, a second barred door beyond the entrance stairs and a grille. A high curtain of m masonry protects the base of the keep at the external side, a and between that curtain and the tower is a ditch 26.3 ft. w

wideand entirely paved, whose bottom is 16.4 ft. below the sill of the postern. The entrance passage permits one to take at the right a stairs ending in a large screw stairs serving all the stories. Turning to the left one reaches the privies B. At D is a very large well, that has not yet been emptied, but which in its actual state is not less than 98.4 ft. deep. On the same level by the entrance corridor one enters a hall with 12 sides and 12 recesses in two stories to store provisions and arms; one of these niches, the second from the well, serves as a fireplace. That hall is lighted by two square windows very high above the floor, and was vaulted by means of 12 arches ending at a central keystone pierced by a round opening to permit hoisting to the top arms and defensive machines. We have made an excavation at the middle of that hall in order to determine if a subterranean story existed; but the excavation showed us only that the rock had very little depth, so that pioneers who succeeded in piercing the lylinder at t the level of the ditch could have passed through without finding a void anywhere. One will note that from the bottoms of the recesses to the exterior of the tower, the mansory has a thickness of not less than 18.0 ft.

The small stairs leads us to the second story (38), vaulted like the ground story, having recesses, three windows, privies and a fireplace E with an oven behind it. Below one of the window openings was placed in the 15 th century a cabinet with a private passage, this change is indicated on the plan by a gray tint. At the back of one of the recesses at the right is opened a narrow passage leading to a drawbridge D communicating with the defensiwe gallery of the curtain. (See description of the castle in Art. Chateau, Fig. 17).

Resuming the screw stairs, we ascend to the third story, w which presents one of the most beautiful conceptions of the m middle ages. This story is vaulted like those below it, and is composed of a hall with 12 sides surrounded by a gallery raised 10.8 ft. above the floor of this hall, thus forming a wide portico with balconies arranged to collect the entire garrison at a single point, permitting each one to hear the general orders and to see the commandant at the centre. Two windows and the central opening light this hall. Beneath the balconies at G are recesses adding to the area of the hall. The

screw stairs is arranged so as to give entrance at the right and left to the portico.

The fourth story (38) is covered, and is pierced by numerous slots and has battlements, stone corbels project strongly on the exterior, being intended to support double defensive galleries suited for the defense. The central vault was covered with lead like those of the portico. The battlements were closed by pointed asches and surmounted by a beautiful cornice with double crockets and a drip.

A section of this keep made at O P better than any description explains the grand arrangements of the great tower of the castle of Coucy. We have represented at the top a part of the double defensive galleries placed on stone corbels.(39). Four great stone pinnacles with cross-flowers and crockets surmounted the ridge of the battlement wall, these pinnacles are indicated in the engraving of Du Cerceau, and among the ruins t taken from the ditch, we have found fragments of them in a beautiful style of the beginning of the 13 th century. In that keep all is built on a scale larger than nature, sill walls in the openings of the battlements, steps of the stairs, benches and railings seem made for men above the ordinary height. The halls were entirely painted in the interior on a thin coat of lime covering the masonry, which is coarse.(Art. Peinture). The masonry is well built in courses 1.3 to 1.6 ft. high; the mortar is excellent with thick and well filled beds. The sculpture is treated with particular care and is among the most b beautiful of that epoch, it is entirely painted.

Engineer Metezau was charged by cardinal Mazarin to destroy the castle of Coucy, and wished to blow up the keep. For that purpose he charged a mine chamber at the centre and 6.6 ft. below ground, whose traces we have found. He thought thus to burst the enormous cylinder, but the explosion had no other result than to send the central vaults up in the air, and to cause three main cracks in the surface of the stone tube. M matters remained in that state until recent times. New movements caused the fear of the fall of one part of the cracked tower, works of restoration were undertaken under the direction of the Hostorical Monuments dependant on the ministry of State, and today this beautiful ruin is protected from storms; the cracks have been repaired and the crushed parts consolida-

consolidated. Id the vaults were rebuilt, one would find the keep of Enguerranr III in all its wild magnificence. The truly original arrangement of the keep of Coucy is that of the third story designed to collect the garrison.

We endeavor to give a feeble idea of it in Fig. 40. If there be reproduced the thought of a thousand armed men gathered in the rotunda and its portico arranged like boxes of a wall for a play, few openings lighting that multitude, at the centre the master giving his orders, while men hasten to hoist by a windlass arms and projectiles through the openings of t the vaults. Or again at night some lamps are attached to the portico, the garrison sleeping or talking in that vast gathering of men, that one hears the noise outside coming through the central opening of the vault, the call to arms, the rapid steps of the defenders on the wooden defensive galleries, certainly one would imagine a scene of singular grandeur. However far the imagination of novelists or historians could go in s seeking local color, it would represent to them with difficulty what the view of such grand monuments, so simple in their arrangement, makes intelligible at a glance. Thus we advise all those sometimes desiring to live in the past to see the castle of Coucy, for nothing better depicts feudalism in its power, its customs, its entire warlike life, than this admirable remains of the castle of Enguerrand.

Norman keeps are barracks more or less well defended, built by craft and mistrust; petty means are accumulated to defeat the assailant, they are dens rather than eidifeces. At bottom is no general arrangement in those fortresses, but many expedients. The Norman keep still retains something of the den of the crafty savage; but at Coucy is recognized the methodical conception of the civilized man, who knows what he wishes, and whose will is powerful; here are no more experiments; the fortress is built rapidly at one spurt, all is foreseen and calculated, and that with an amplitude and simplicity of means made to astonish the undecided man of our time.

Yet already in the 13 th century, feudalism lost its heroic customs, and one may say that Enguerrand III is the last and greatest model of them. These dwellings of giantu cannot suit a nobility loving its ease, politacally weakened, ruined by its luxury, its struggles and its rivalries, foreseeing the

end of its power and incapable of retarding it. The great vassals of S. Louis and of Philip the Bold were no longer able t to construct such fortresses; they could not resolve to pass the days of a long siege in those great vaulted halls, dimly lighted, in company with their men at arms, partaking of their bread and provisions. Also a matter worthy of note, the Nr Norman keep is divided into a sufficiently large number of r rooms; the lord can live there alone, he seeks to isolate himself from his men, and even at need to ensure himself against treason. The keep of Philip August, of which Coucy presents the most complete specimen, is the last fortress, the refuge of an armed body acteng together, moved by the idea of unity of action. The tower is cylindrical; that form of plan alone indicates the system of defense proceeding from a centre where is the commandant, to extend and radiate, so to speak. Thus one sees appear among us in full feudalism that principle of military force, which first of all resides in unity of command and the confidence of soldiers in their supreme chief. And th this principle, that Philip August so well understood and put in practice, this principle adopted by some great vassals at the beginning of the 13 th century, feudalism abandoned when the monarchical power extended and drew to itself the force of the country. Thus the monuments always retain the imprint of the time that erected them.

The internal paintings of the keep of Coucy only consist of white panels on a yellow ochre ground, with beautiful borders around the archivolts. Soon men did not content themselves w with these decorations in a severe style; they desired to cover the walls of the halls with subjects, personages, heraldic arms, and legends. The feudal nobility loved letters, occupied themselves with art, aimed to instruct youths, and to p present before their eyes beautiful examples of chivalry. "In the year 1456, May 1, I, lord of Caumont, being at the age of 25 years, had a beautiful garden of flowers in which was abundance of birds, who sang beautiful and pleasing songs, and in several ways gave myself up to enjoyment, so that I thought much on the fact of this world, and I saw very subtle and inclined to do much, and that all this was nothing, compared to the other, that endures without end."

"And then I remembered my little children, young and innoce-

innocent, that I desired to become good and honorable, and h had good care, as a father should wish for his children. And because according to nature they must live longer than I, and that I could not teach or indoctrinate them, for it is necessary for me to leave this world, like others, I have thought that I should make and leave to them while here, a book of i instruction, to show how they should govern themselves, according to what is like myself." [1] This passage indicates the t tendencies of the feudal nobility at the beginning of the 14 th century, the times of savage violence were past; many lords devoted themselves to study of letters and arts, seeking to surround themselves in their castles with all suited to render these residences supportable, and to elevate the minds of youths."At the head of the said city (Mazieres) is a very beautiful and strong castle on the river, well enclosed ind with great machicolated towers all around it, and within all is painted marvellously with battles, and there are found all t the generations of Christians and savages, such a one, male and female, each according to the costume of his country." [2]

Note 1.p.83. Voyage du seigneur de Caumont, pub. by marquis de la Grange. Paris. 1858. Introd. p. 6.

Note 2.p.83. The same. p. 27.

We find the traces of these internal decorations of keeps already in the 13 th century. (Old French poem).[3]

Note 3.p.83. Lai de Gugemer. poems of Marie de France. 13 th century. Pub. by Roquefort. Paris. 1832.

Here the subjects of the paintings are borrowed from pagan antiquity. Frequently in these paintings, the artists interpreted in the most singular fashion the scenes of Greek and R Roman history, subjecting them to the chivalric manners of the epoch. Hector, Joshua, Scipio, Judas Maccabee, Cesar, found themselves comprised among the valiant knights with Charlemagne, Roland and Godfrey de Bouillon. The heroes of sacred aud profane history had their coats of arms like the chevaliers o of the middle ages.

Men that prided themselves on chivalric sentiments, who regarded courtesy as thefinest of the qualities of society, of a society of women as the only one that could form youths, m must necessarily abandon the gloomy keeps of the time of Philip August. Still it was always necessary to think of the de

defense. In the 14 th century feudalism renounced the great cylindrical keeps; it adopted by preference the square tower flanked by turrets at the angles, as more suited for habitation. On this programme Charles V caused the rebuilding of the celebrated keep of Vincennes, that still exists, excepting some modifications, that have modified the details of the defense.[1] This keep, commanding the exterior and placed at a side of the enclosure of the castle, is protected by a walled ditch and a rectangular curtain wall, with a gate well protected next the court of the castle. As everyone knows, it is composed of a square tower about [illegible] ft. high with four angle turrets ascending from the ground. Its upper part is defended by two stories of battlements. It was always covered by a platform placed on the vault. In the interior each story was divided in several rooms, a lord chamber, one of medium dimensions, and a cabinet, without counting the turrets, these rooms for the most part had fireplaces, an oven, and were lighted by beautiful windows terminated by pointed archivolts. Already the keep of the Temple at Paris, completed in 1306,[2] had been built on this plan; its upper part, instead of being terminated by a platform, was covered by a high roof with four conical roofs on the angle turrets. But the keep of the Temple was rather a treasury, a deposit of charters and money, than a defense.

Note 1.p.[illegible]. "Item, outside Paris (Charles V caused to be built) the castle in the forest of Vincennes, that is very notable and beautiful." Livre des faits et bonnes moeurs du sage roy Charles. (Christine of Pisan).

Note 2.p.[illegible]. Du Breuil. Antiquites de Paris.

We believe it useless to multiply examples of the keeps of the 13 th and 14 th centuries, for they do not differ greatly in their general arrangements; they are square or cylindrical; if square, they strongly resemble the covert built at that epoch, and differ from them only in dimensions (Art. Tower); if cylindrical after the end of the 13 th century, they contain vaulted stories, and cannot be compared to the keep of Coucy, that we have just given. Only at the moment when feudal manners were transformed, or the lords castellans claimed to have residences less shut in and gloomy, did the keep abandon the form of the tower, that it had adopted about the end of the

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12 th century to become that of a defended residence, but containing all that could render the habitation easy.

Louis of France, duke of Orleans, second son of Charles V, born in 1371 and assassinated at Paris in Nov. 1407 in Rue B Barbette, was a great lover of the arts. This prince rebuilt the castle of Pierrefonds, Ferte-Milan, Villers-Cotterets, ca caused to be executed considerable works on the castle of Coucy, that he had acquired from the last heir of the lords of Coucy. Louis of Orleans was the first that knew how to combine the defensive arraugements adopted at the end of the 14 th c century in feudal habitations with the comforts of a nobleman's residence. The castles that he has left us, and whose most c complete specimen we find at Pierrefonds, are not only magnificent residences, that would still be habitable in our days, but are strong places of the first order, that the artillery already perfected in the 17 th century could alone reduce.

It is strange that the iufluence of the princes of the younger branch descended from Charles V upon the arts in France has not yet been stated, as it merits. The monuments left by Louis of Orleans and by his son Charles ahe nearly half a century in advance of the movement of art in our country. The c castle of Pierrefonds, begun in 1400 and completed before the death of the first of the Valois, is still a strong place of the 14 th century, but decorated with refined taste like the residences of the time of Charles VIII.

The keep of this castle contains the lodging of the lord, n no longer enclosed in a cylindrical or square tower, but distributed so as to present a vast and commodious habitation, provided with the accessories required by an elegant anf exquisite existence, at the same time that it is a powerful and perfectly extended defense, impossible to attack other than w with siege batteries, now at the beginning of the 15 th century, siege artillery was still unknown. cannon were of small dimensions, carried in the campaign on horses or wagons, and were scarcely employed except against the formidable constabulary of that epoch. Let us examine the arrangement of the keep of Pierrefonds, that we have already given in the general plan of that castle.(Art. Chateau, Fig. 24).

The keep of Pierrefonds (41) [1] is near the principal entrance A of the castle, and flanks the entrance in a manner to

completely forbid approach. It also possesses the postern B, very high above the external ground. Thus it fulfils the ordinary conditions that desire the keep to have two exits, one visible and the other concealed. The gate A of the castle, p protected by a drawbridge, folding doors, a guard room a, portcullis and a second barred gate, had as a customary addition at that epoch, a postern for persons on foot with its special drawbridge b, and its bent entrance beside the guard room; fu further the corridor of the entrance was enfiladed by a turret placed on the buttress c. To enter the residence one found a beautiful flight of steps D with two horse-blocks (Arts. M Montoir, Perron), then a great winding stairway E ascending t to the upper stories. A false portal F gave entrance to the vaulted ground story serving as a storehouse for provisions. By sufficiently wide stairs G one descends from that great s story to the small cellar, arranged with recesses to receive wines of various sorts. The walls of this ground story are 9.8 to 13.1 ft. thick and are pierced by few openings, particularly on the external side. A little doorway H, masked in the r reentrant angle of the square tower allows entrance to the v vaulted hall I forming the ground story of that tower, and to take a stairs with straight flights ascending only to the second story. We shall return to that immediately. The postern B is equipped with portcullis and folding doors and surmounted by machicolations, that extend entirely along the curtain, w with its sill set about 23.0 ft. above the external ground, which at that place only shows a road 19.7 ft. wide; then below that road is a pronounced precipice, inaccessible, at the foot of which passes one of the stairs ascending to the castle, defended by a cross wall pierced by a door, on the other side of the door and commanding the walley is a mound of earth made by men, which was certainly crowned by a work now destroyed. From the postern B one can then, either by a plank or a drawbridge, defend the door of the stairs of the castle, pass above that door and reach the advanced work commanding the valley a afar. The postern B thus served for a sortie of the garrison, to take the offensive against the besieging force, and bring aid and provisions. One will observe that the space K is a co court with floor below the ground of the principal court of the castle, and that to enter that principal court, it was

necessary to pass through the second postern L, whose sill is raised above the ground K, and which is defended by a portcullis, folding doors and machicolations with battlements. T The stairs M, which admits to the chapel N and the court, ascends from the bottom, and allows one to reach the room of t the purtcullis.

Note 1.p.85. One will note between this plan and that given in the entirety of the castle, are some differences of details, resulting from excavations executed in 1858 and 1859 in this domain by order of the emperor. These excavations have brought to light certain lower parts of the buildings, of which one could have had but a very imperfect idea. The plan that we now give may be regarded as properly accurate.

Continuing to ascend by this screw stairs, one arrives (42) over the room of the portcullis in the story pierced by machicolations; traversing the corridor, one descends a stairs O, which leads to the second story of the square tower, from which one can penetrate into the great rooms of the principal r residence, which consist of the vast hall P, in direct communication with the great winding stairway E, the two rooms S with lodging S above the entrance gate, and chambers located in the two great towers defending the exterior. At T are wardrobes, privies and closets. One still sees in place the beautiful fireplace, that warmed the great hall P, well lighted by great windows with tracery, with double transom bars. A third story was nearly similar to this, at least in general arrangement; both were defended only by the thickness of the walls and flanking by the towers.

Only on the fourth story begin to appear the defenses.(43). At the feet of the great gables that close the roofs of the p principal residence are placed machicolations with battlements at c and d. The two great round towers and the square tower continue to rise, separated above the roofs of the residence, and all three are crowned by machicolations with slots and c covered battlements, then above by a final parapet with battlements open to the sky at the base of the roofs. The square tower also has three flanking turrets on its three buttresses. At the height of the third by continuing to ascend the stairs M from the fostern, one finds a parapet with battlements above the machilocations of that postern, and a door giving entrance

to the square tower, from thence one takes a little screw stairs V, which ascends to the three last stories of that tower, not in communication with the interior of the great residence. Yet from the story of the machicolations of the square tower may be taken a rampant stairs above the covering of the great gables with battlements of the principal habitation, rejoining the machicolations of the great angle tower, just as by the stairs of the turret C by ascending the steps behind the gables with battlements on that side, one can reach the machicolations of the great tower near the entrance. On the external front, these two towers are placed in communication by a parapet with battlements at the base of the roofs. From lobbies and wardrobes T one descends by the defensive gallery X of the great curtain defending the exterior with its turret X' over the postern. This defensive gallery was also in communication with the lower defensive galleries of the tower of the chapel N. From the hall R or the tower R', one could likewise reach the defenses of the castle on the south side by the room S 1 located in the fourth story above the entrance by descending the stairs M.

If our description has been followed with some care, it will be easy to understand the arrangements in general and detail of the keep of Pierrefonds, to conceive an accurate idea of the programme fulfilled by the architect. Vast storehouses in the ground story with the fewest exits possible. On the outside at the entrance side, which is that most favorable for at-attack, enormous and massive towers are solid for the height of the slope and able to resist the sap. At the side with the postern is a very thick and high protecting curtain with an internal court between that curtain and the residence, a second postern to pass from this first court into the principal court. As an excess of precaution, on that side is a very n high square tower flanking the residence on two of its fronts, commanding the entire court K and also the outside, with turrets at the top flanking even the sides of the square tower. Besides is a possibility of isolating the two round towers a and the square tower by closing some narrow passages entering the residence, thus rendering the defense independent of the habitation. A possibility of communicating from one of these towers to the other by the upper defensive galleries without

passeng through the rooms intended for habitation. Besides t the gate of the castle and the great stairway with a flight of steps is a private exit for the square tower, either by the little door at the reentrant angle, or by the stairs of the chapel. A private exit from the corner tower by the curtain in which is pierced a postern, and by the stairs of the chapel. A private exit from the tower of the entrance gate by the rooms situated over that gate and the stairs U descending to the ground. Easy communication established between the towers of the defenses of the castle by the defensive galleries. Rooms defending themselves, either on the side of the court K or on the side of the entrance of the castle by means of battlements and machicolations at the base of the gables. These rooms, well protected on the external side, masked and flanked, having but a single entrance for the apartments, that of the entrance flight of steps, and this entrance being placed in the court of honor, commanded by one face of the square tower. Impossible for every person not familiar with the arrangement of the residence to pass through these passages, stairways, turns and secret exits; and for him that lives there, a facility for passing rapidly to all points of defense, either of the keep itself or of the castle. Facility for making sorties if attacked. Facility for receiving aid or provisions by the postern B without fearing surprises, since that postern opens into a first isolated court, and only into the principal court by a second postern, whose portcullis and barred doors are guarded by the men of the keep. Beautiful halls are well arranged, orientated and lighted; private apartments with cabinets, lobbies and private stairs for service. Certainly it is far f from the keep of Coucy, whici is only a tower where chiefs a and soldiers must live in confusion, and this last keep, which even today would be an agreeable and commodious residence; b but the feudal manners of the lords of the 15 th century resemble little those of the castellans of the begennning of the 13 th century.

We complete the series of plans of the keep of Pierrefonds by an elevation of this residence (44) taken from the side w with the postern on the line G Z of the plans. At A is seen the great corner tower, at B is the square tower; between them are the two stepped gables of the halls; at C is the tower

of the chapel, into which the occupants of the keep could pass directly through the square tower and the little screw stairs marked M on the plans without going outside. There is visible the high curtain between the great angle tower and that of the chapel, which masks the isolated court R. At the middle of th that curtain is the elevated postern, that communicates with an advanced work by passing through the gate D of the external stairs of the castle. In construction nothing can rival the keep of Pierrefonds; the perfection of the jointing and cutting, of the setting of all the regular courses of a uniform thickness of 1.08 ft. between beds, is calculated to surprise persons that practise the art of building. In these walls of unusual height and of unequal thickness is neither settlement nor crack; all that was built with regular levels; no anchors a e found, and although the two round towers were blown up by mines, and the walls were sapped from top to bottom, yet the parts still standing seem to have been built yesterday. The materials are excellent, well selected, and the mortar has a perfect strength.[1] The numerous traces of woodwork, of the attachment of hangings, that are still perceived on the internal walls of the keep of Pierrefonds, sufficiently indicate that these apartments of the lord were richly decorated and furnished, and that this residence combined the advantages of a strong place of the first order with those of a pleasant h habitation situated in a charming country. Our custom if symmetrical arrangement in buildings after the 17 th century make it appear strange to see the irregularities noted in the plan of the keep of Pierrefonds. But as we stated in Article Chateau, the orientation, view, requirements of the defense, exerted the chief influence in the layout of these plans. Thus for example, the obliquity noticed in the eastern wall of the habitation (a skew not unseen in execution) is evidently imposed by the desire of obtaining windows on the exterior of a court, where the country presents changing points of view, and leaving the place necessary for flanking the square tower, as well as the internal postern between that tower and the chapel, the arrangement of the plateau also not permitting the greater p projection of the tower containing the chapel. The plan of the part intended for the apartments is given by the needs themselves of that habitation, each room having only the dimensions

necessary. In elevation the difference in height of the posts of the plan are even improved by the needs of the defense or of the arrangement.

Few castles of the 14 th and 15 th centuries possessed as extensive keebs, as beautiful and as suitable to lodge a great lord, as that of Piereefonds. Most keeps of that epoch, a although more comfortable to occupy than the keeps of the 12 th and 13 th centuries, however are only composed of the habitation more or less well defended. We shall find an example of those feudal residences at a reduced scale in the same province.

Note 1.p.90. The emperor Napoleon III recognized the importance of the ruins of Pierrefonds from the point of view of the history of the arts. The keep will resume its former appearance; already the portion of the square tower, that had be been destroyed, has been restored. we shall soon see the most beautiful specimen of the feudal architecture of the 15 th c century in France restored by the august will of the sovereign. We do not have so many ruins in our country, and we appreciate their value with difficulty. The castle of Pierrefonds, rebuilt in part, will make known that art both civil and military, which from Charles V to Louis XI was superior to everything then done in Europe.

The castle of Vez depends on the castle of Pierrefonds; it is situated not far from that domain on the edge of the forest of Compiegne near Morienval, on an elevated plateau that dominates the valleys of the Automme and the Vandi. Its military location is excellent and because it completes at the south the line of defense of the approach to that forest, protected by the two streams mentioned, by the castle itself of Pierrefonds at the northeast, the defiles of the forest of Aigue and the river Aisne on the north, by the plateaus of Champlieu and the market town of Verberie on the west, by the course of the Oise on the north-northwest. The castle of Vez is a very old post, placed at the extremity of a ridge between two little valleys. Louis of Orleans must have entirely rebuilt it, w when he desired to take his precautions at the north of Paris, to be in a state to resist the claims of the duke of Burgundy, who on his part fortified himself at the south of the royal domain. Compared to Pierrefonds, Vez is only a post defended

by an enclosure and a little keep marvellously located, built with the greatest care, probably by the architect of the castle of Pierrefonds.[1]

Note 1.p.92. The mouldings of the keep of Vez, the mode of construction of certain details of the defense, recall exactly the construction, mouldings and details of the castle of Pierrefonds. The keep of Vez consequently dates from 1400.

This keep (45) rises at A (see general plan), at the angle formed by two curtains, one of which at B dominates a precipice B′, the other at C is flanked externally by turrets, and is separated from a lower court or bailey by a wide ditch. On the side G the plateau descends rapidly toward a deep valley: thus the two curtains H, H′ are lower than the two others at B, C, and their covered way is found at the level of the plateau on which rises a habitation K of the 12 th century almost entirely rebuilt at the beginning of the 15 th. That residence i in ruins today, but was a charming structure. The gate of the castle is at I, defended by two towers of small dimensions. One still sees some remains of the defenses of the bailey E, but now converted into walls and terraces.[1] The keep is d detailed in the plan of the ground story X. Its entrance is at L, and consists of a narrow postern with a drawbridge [2] giving admission to a large winding stairs ascending from the ground. Each story contains two rooms, furnished with fireplaces and closets. At P is a well. One sees at F the ditch and at M the entrance to the castle with its towers and skew bridge. The curtain C is defended by external flanking turrets O, while the curtain B, that had little to fear from attack from outside, because of the precipice, was protected internally by f flanking turrets R. By the little towers S S′ built at the t two extremities of the elevated curtains, men ascended to the defensive galleries and these curtains by means of stairs. At V was a postern descending from the platform of the precipice. When one examines the location of the plateau, the plan of the angle keep with external fronts sweeping the most accessible vicinity of the castle is perfectly explained. The small angle towers rising from the ground also form the flanking of t the second order, as a provision against a near attack.

Note 1.p.94. This domain now belongs to M. Poillet, the keep alone serves as a residence.

Note 2.p.24. This postern was replaced in the 16 th century by an opening at the level of the ground.

Fig 46 gives a perspective of the keep of Vez taken from the interior of the enclosure, and shows the arrangement of the f flanking turrets R of the curtain B, the postern with its little ditch and drawbridge, the opening of the well, the arrangement of the machicolation-privies, beside the stairs, the t top of the stairs terminated by a turret serving as a watch tower. From the second story of the keep one passes to the d defensive galleries of the two curtains by small well defended doors. Thus the garrison of the keep, in case of attack, could repair quickly to the two curtains on the two fronts, which alone could be attacked. If one of these fronts at C were taken (it is the weakest on account of the nature of the ground and the opening of the gate), the defenders could still retain the second front B, strengthened by the internal turrets R (see plan), if they could not keep the second front, t they retreated into the keep, and renewed the offensive or ca capitulated at leisure. In a post so well arranged, a garrison of 50 men would easily arrest an army corps for several da days; it must be said that the assailants, surrounded by ravines, small streams and forests, stopped on such a location, would have great difficulty to protect themselves from a relief corps. Now the castle of Vez was nothing more than a fort intended to hold one point in the great line of well chosen defenses, perhaps there has not always been sufficiently observed the relation almost always existing in the middle ages between the various fortresses of a territory, they are studied separately, but no account is generally taken of their importance anf their relative utility. From this point of view, it appears to us, that the fortifications of the middle ages open a new field of studies.

Such is the persistent effect of traditions, even in epochs when one claims to be free from them, that we see the last v vestiges of the feudal keeps even enter into chateaus built during the 17 th century, when men no longer thought of the fortified residences of the feudal castellans. Most of our chateaus of the 16 th and 17 th centuries still retain at the centre of the building a great structure, certainly not a foreign importation, but much rather a last memorial of the keep

of the middle ages. We shall still find this habitation dominant at Chambord, S. Germain-en-Laye, the Tuileries, and later at the chateaus of Richelieu in Poitou, Maisons, Vaux near Paris, Coulommiers, etc.

DORMANT. Frame of Door or Window.

This name is given to a fixed frame of joinery, and to which is hinged the door or sash. In the first times of the middle ages, doors and windows were hinged in the rebates in the stone without frames; but this primitive means, a tradition of antiquity, had the inconvenience of allowing air to pass through these rebates, making interiors very cold in winter. When the customs of ordinary life commenced to become more effeminate, men claimed to have rooms well closed, and doors and w windows were hinged to wooden frames, fixed in rebates reserved in the stone. Frames appeared in private architecture only about the 15 th century.

DORTOIR. Dormitory.

Naturally dormitories occupied an important place in the old religious establishments. They are most frequently built in the extension of one transept of the church, so as to place the religious in easy communication with the choir for the n night offices, without going into the cloisters. When the season was rough or the weather bad, the religious descended under cover into the transept and from there passed into the ch choir. Dormitories were placed in the second story over cellars or services of the monastery, that produced neither odor, dampness nor too much heat. The dormitories of monasteries a are ordinarily divided lengthwise by a row of columns forming two vaulted aisles, or at least are ceiled; they receive light and air from the west and east, by reason of the position of the building imposed by the invariable orientation of the church. Great abbeys possessed dormitories built with magnificence, and presenting an appearance truly monumental. Modern science has recognized, that for each person during the time of slumber is required at least 1125 cu. ft. of respirable air. The lungs of the monks of the 12 th, 13 th and 14 th centuries, could consume a much greater volume of air, if it s seemed good to them, and still they rose after midnight to

chant matins.

Lebeuf [1] describes thus the dormitory of the religious of the abbey of Val Notre Dame dependent on the deanery of M Montmorency; "The refectory is quite a small square, it is beneath the dormitory, which is very light, and whose vault is separated by columns or old piers delicately wrought, as to be seen in several other dormitories of the order of Citeaux built in the 13 th or 14 th centuries." It is necessary to believe that the dormitories of the religious were arranged l like the dormitories of our barracks or our schools. Those g great halls were divided by low partitions into as many little cells as there were religious; these cells or stalls contained a bed and the most indispensable furniture, they must remain open or be closed only by curtains.

Note 1.p.97. Hist. du dioc. de Paris. Vol. IV. p.215.

In the 16 th century all religious orders desired to have cells or separate chambers for each monk, as practised in our seminaries. The same customs were observed in convents for w women. Yet from the 12 th century the Cluniacs, who were persons loving their ease, had already established chambers of distinct cells for each religious, and sometimes veen these cells were richly furnished. Peter the Venerable complained of them in his time, and S. Bernard arose with his habitual e energy against these abuses, that he regarded as opposed to monastic humility. Thus the first dormitories of the Cistercians seem to have been common halls furnished with beds, but without separations between them.

Here (1) is the external appearance of one of these common dormitories; it is the dormitory of the convent of Chelles ((convent of nuns); it was built at the beginniug of the 13 th century;[2] the ground story was occupied by cellars and the he heating room; a row of columns supported the carpentry forming two ceiled tunnel vaults with visible tiebeams. In Article Architecture Religieuse, we have had occasion to give a certain number of these buildings; it seems useless to enlarge here on their general arrangement, their form and the details of their very simple architecture, but perfectly appropriate to the object. Thus for example, the windows were habitually composed of a fixed transom opened especially to light the hall, and of a lower part to be opened for ventilatiou.(Art. Fenetre).

If each religious had a chamber, the name of dormitory was s still given to the building or story containing them, and p particularly to the wide middle corridor giving entrance to right and left to each cell. Yet there still existed in the 16 th century dormitories of convents of women arranged like the chambers of our barracks, i.e., consisting of several large rooms each containing several beds. We find the proof of this in the Pantagruel of Rabelais.[3] "But said the abbess, w wicked that yow are, why did you not give a signal to your neighbors in the chamber?"

Note 2.p.97. Monog. d. abbayes. Lib. S. Genevieve.

Note 3.p.97. Book III. Chap. 19.

DOSSERET. Pier. Jamb.

The end of the wall at right angles to another and supporting the lintel or arch of an opening. A A (1) are the jambs o of an opening.

DOUELLE. Intrados.

This is the internal surface of an arch, also designated by the name of intrados. In a vault, each voussoir has its intrados. A is the intrados of the voussoir represented in Fig. 1.

EBRASEMENT. Splay.

This indicates the space between the frame of the window and the surface of the internal wall of the room. This splay is enlarged toward the interior to facilitate the entrance and to also receive the folds of a casement window.(Art. Fenetre).

ECAILLES. Scales.

Employed only in the plural tc designate a sort of ornamentation very common on edifices in the middle ages to decorate the caps of buttresses, slopes of gutters, tops of pinnacles, stone spires, etc. Scales are evidently an imitation of covering by wooden tiles (Art Bardeaux); thus it is especially in provinces where that sort of covering was employed, i.e., in Normandy, Picardy, Soissonais and in Ile-de-France, that scales appear on stone structures from the 12 th century. In Normandy itself it is not rare from the beginniug of that century to see certain vertical surfaces, grounds of blind arcades, f

for example, decorated by scales sculptured on the stone and presenting a very slight projection. This was one means of distinguishing those grounds in the midst of the solid parts of the construction, of studying them, so to speak, and for rendering them less heavy in appearance. The reliefs in the 11 th and 12 th centuries, in which are represented edifices, frequently show the surfaces of those edifices thus decorated. We have given a remarkable example of them in Art. Architecture Religieuse, Fig. 47, taken from a capital of the church of S. S Sauveur of Nevers. The singular church of Thaon near Caen shows us a portion of its external surfaces decorated by scales of square form, recalling those facings with wooden tiles so much in use in private structures built of half timber work. These scales are sometimes superposed or more frequently contrasted, i.e., solids over voids, as indicated in Fig. 1. By dividing the rainwater that strikes the suffaces, by removing dampness from the joints and discharging it, these scales in addition to their decorative effect have still the advantage of preserving external surfaces. If this effect be sensible on vertical walls, by a stronger reason it is so on inclined surfaces, or slopes directly opposed to rain. On elevated inclined stone surfaces, every projection of a form suitable to direct the water is eminently favorable to the preservation of the masonry, by avoiding the uniform soaking of the rain. Whether the architects of the 12 th century had that experience, or merely had in view the decoration of inclined surfaces (further a logical ornamentation since it recalls a covering to tiles of clay or wood), these architects always adopted scales carved on the stone for every inclined surface.

The oldest forms given to these scales present a series of rectangles or billets as shown in the adjacent Fig., or with little round or pointed arches as indicated in Fig. 2.[1] It m must be stated that each row of scales is always cut in the height of one course, the vertical joints being placed at the middle of the spaces left between the scales. Rainwater falling between A and B is led by the cut stone along the two edges A C, B C; at C it drops off and reaches the eud D, and so successively to the cornice. The parts most wetted are then the edges of the scales' but even by their projection these edges dry more easily than the flat surfaces; dampness then remains less time on the surfaces, this is the entire secret

of the preservation of these surfaces covered by scales. Delicate shadows and lights, that play on these little sculptured surfaces, give lightness and elegance to the coverings, th thus architects have also used this means in the epoch of the Renaissance. We cannot pretend to give all the examples of s scales cut on surfaces, but will content ourselves by indicating the principal ones.

At the end of the 12 th centurw scales, particularly in the edifices of Normandy and Ile-de-France, take the form of little stilted pointed arches, as indicated in Fig. 3. Until then scales project little and present equal relief in their entire length. But in the great monuments erected at the beginning of the 13 th century it was necessary to obtain pronounced effects in the execution of details at so small a scale; thus we see in picardy, for example, on the pyramids surmounting the stairways of the two towers of the facade of the cathedral of A Amiens scales in strong relief, and in a form evidently intended to produce a great effect at a distance.(4). In Ile-defrance, the architects never exaggerated thus the importance of details, that after all should not destroy the quiet of p plane surfaces, and that are not made to contrast with sculpture. Yet sometimes the scales cut on edifices of the first h half of the 13 th century in Ile-de-France present greater p projection at their lower ends than at top. their most general form is that presented in Fig. 5. In this case the scales are cut according to the profile A or B. Scales strongly detached at their lower ends according to profile A belong rather to spires of towers, i.e., that are placed at a great height. On the slopes of buttresses their projection is equal f for their entire length.

In the 14 th century scales approach more nearly to the form of wooden tiles; they nearly touch each other, have their two sides parallel, are elongated and terminated by clipped corners.(6). The pinnacles of the choir of the cathedral of Paris (14 th century) and those of the cathedral of Eu (15 th century) are covered by scales cut in that form.

Scales belonging to monuments erected in the provinces, and on which stone roofs hawe been adopted since the Romanesque e epoch, as in the South and West of France, are not arranged like wooden tile coverings; they are returned so as to leave

between them as many little channels suited to remove water f from the vertical joints. (See what is said on this sort of scales in Art. Clocher, Figs. 14, 15).

ECHAFAUD. Scaffold.

In the art of building, by a scaffold is understood the temporary carpentry work established to permit the construction of the masonry. Scaffolds are attached to the construction or are independent of it. The structures of the middle ages, like the Roman buildings, were erected by means of scaffolds attached to the masonry, and that were fixed in building it. For this purpose men left in walls of bricks, rubble or cut stone holes about 6 ins. square, deep, in which were fixed projecting timbers or logs or putlogs, and the holes left to receive them are called putlog holes, the vertical blocks are termed struts. The architects of the middle ages built thus their l largest edifices by means of putlogs and struts of moderate size. On these putlogs, placed quite near together, were laid planks, platforms, on which the workmen remained; these stages of more or less width according to need, were repeated at each 6 ft. at most, so as to make every part of the structure accessible to the workmen. Materials of large size were never placed in these stages, but on the walls themselves, by means of machines placed on the ground corresponding to cranes or hoists fixed on the structure itself. Besides, the materials were nearly always hoisted inside, landed on the walls, set and jointed by the workmen moving on the walls or the scaffolds.

The scaffolds of a Roman or mediaeval edifice then rose at the same time as the construction. The constructors of those distant times certainly did not incur great expense for scaffolds. They left the putlog holes visible on the surfaces, only taking the trouble to fill them when they removed the scaffolds after the construction was completed. Then the edifices were not dressed after erection, each stone was set entirely cut, and nothing more was to be done; on the day when the last stone was set in place, the edifice was completed, and the scaffold could be removed. It must also be stated that the g great Gothic edifices presented strong recesses at different heights, which permitted the starting of a system of scaffolding on each recession, without its being necessary to support

the scaffolds from the ground. Yet there are edifices, for example defensive towers, that rise vertically to a great height without projections or recessions. It is interesting to study how those enormous structures were erected.

The construction of the keep of Coucy, that presents a cylinder whose vertical surfaces are 197 ft. high, required only an extremely simple scaffold, one that had also the merit of avoiding the slow hoisting by machines. One notes on the external surface of the enormous cylinder a series of putlog holes arranged in a spiral and forming a very gentle slope by r reason of the unusually large diameter. These putlog holes a are spaced about 13 ft. apart, and are double, i.e., exhibit two spirals as shown by Fig. 1. By means of timbers fixed in the upper holes - and relieved by struts resting in the lower holes B, the constructor thus established at the same time he erected the structure a spiral road whose small inclination permitted the transport upwards of all materials on little ca carts drawn by men or by windlasses placed at certain distances. Fig. 2 will illustrate that operation. The masons and s setters took care to level always the construction around the entire circumference of the keep, as shown here, and on that level they passed and unloaded the stones. To set the external surfaces vertically (surfaces cut previously on the work yard), there sufficed a plumb line and a wooden radius bar t turning horizontally on a vertical axis fixed at the centre of the tower. Our masons now proceed in the same manner, when they build those great brick chimneys of iron works, from the interior of the flue without scaffolds. The scaffold whose t traces exist on the walls of the keep of Coucy is actually o only a transport road, and this road might be very wide as s shown by Fig. 3, giving one of its fixed trusses. At A and B are two holes spaced 3.9 ft., by two ties G connecting the t timbers next the holes, one could have two struts E F, the l latter forming an X-brace to a tie G. The head of the strut F and the foot of the tie G enter into a post H, fasteuded to the timber B at its lower end. A final strut K enters the foot of that post B and relieves the end of the upper timber A. It would thus be easy to have a road 17.4 ft. wide inside a railing. These small trusses received beams that supported cross planks placed to fresent an obstacle to the sliding of the c

carts. It would have required an enormous load to break the trusses so combined, although they were held in the wall only by two fixed ends. Not only the combination of these little trusses prevented them from leaving the holes; but being connected by beams forming a series of polygons around the cylinder, they were always fixed against the wall.

In the provinces where men still built without dressing the front after setting, they have retained these primitive modes of scaffoldiug. The scaffolds are composed only of putlogs f fixed in holes arranged in building and with poles, the putlogs being fastened to the poles by cords. Even in Paris these traditions are retained, and men from Limousin display singular skill in the construction of these light scaffolds composed of logs with diameters averaging scarcely over 4 ins.

In Burgundy and Champagne (a forested country), we have often seen scaffolds used according to the perspective sketch. (4). The part A of the horizontal timber A B is fixed in the putlog hole, this putlog is framed at C at the face of the w wall as indicated by the detail C′. Two pieces D are halved together at top, rest against the wall and are connected by the tie E. Two struts G G are framed to the feet of these pieces and support by tenons the end of the horizontal timber A B. This is a hanging truss with two struts that prevent the horizontal timber from beidiug to right or left under the load to keep it rigid.

It is doubtful that the carpenters of the middle ages, who were very ingenious, in certain cases built scaffolds of carpentry independent of the construction, scaffolds rising from the ground or suspended. We can only have an idea of these s scaffolds by the traces of their anchors still existing on t the monuments. For example, it occurs that above the story of a building so arranged that one cannot erect scaffolds from the ground, there are perceived square holes of 12 by 13 ins. piercing the wall at certain parts, and so spaced as to leave between them the length of a beam; over these well formed large holes are noted other small putlog holes about 4 ins. square and not passing through the masonry. That indicates to us the placing of the scaffold arranged as indicated in Fig. 5. A B is the thickness of the wall; the beams C pass through it and are fixed inside by strong keyed blocks D; two vertical

ties E pivots the beam at the face of the wall on the exterior; into these are halved two struts F that relieve the beam at G and H. On this beam thus made rigid are then erected the scaffolds by poles I and putlogs L with braces K, the putlogs being held by wooden wedges in the holes left in the external surfaces. Such a scaffold offers all the solidity of a carpentry structure rising from the ground.

The excessive height of certain Gothic edifices, and notably the towers of churches surmounted by stone spires, was such that one could not think of erecting these structures by means of scaffolds rising from the ground, for the establishment of these scaffolds would have absorbed considerable sums, and they would have had time to rot ten times during the work of the masons. men erected substructures with poles and putlogs; they profited by recessions carefully arranged in those kinds of structures that take new points of support above the ground; then attaining the height of the platform or galleries from w which the towers rise independently, the lower scaffolds were removed to erect the carpentry yecessary for the construction of these towers. The openings of these towers were then of g great assistance for setting stable scaffolds, suited to resist the violence of the wind and all causes of destriction, w which increase from the time that one ascends much above ground.

However little one examines carefully Gothic structures, he remains persuaded that the architects charged with erectiug them frequently lacked resources corresponding to the nature and importance of these buildiugs. They must then be very saving with scaffolds, that cost very dear and represent nothing after the building is completed. Above a certain height o one also recognizes by the position of the scaffold holes, t that they were suspended. To suspend a scaffold from an already existing monument requires no very wise combinations; but to suspend a scaffold to erect an edifice, before that structure is built, is a problem that seems difficult to solve; o one knows that material difficulties did not stop Gothic architects.

Usually the towers of great churches at the height of the b belfries in their upper parts and below the spires, are pierced by narrow and high double openings. The angles are strengthened by buttresses terminated by pinnacles; but in the reen-

reentrant angle formed by these buttresses, and according to the diagonals of the square on which the plan of these towers is traced, one nearly always notes at the base of the belfry larger or smaller holes, and sometimes rests. Above the vertical portion of the tower, at the base of the spires that ri rise on an octagonal plan, are seen dormers at the eight sides, openings more or less wide, but narrow and high. These a arrangements lead us to admit that the scaffolds intended for erecting the upper and independent parts of church towers were suspended, i.e., that they left the lower part of the facades entirely free. Starting from this principle, let A (6) be the plan of a tower of the facade of a great church at the base of the belfry, B being the plan of this tower at the base of the stone spire, that crowns it. Having two openings on each face of the belfry, we place across these openings scaffold t trusses intersecting at G, and approaching as nearly as possible to the angle buttresses. In elevation each of these trusses gives the sketch F; the four posts G rise in a single piece or are doubled from E to H (on account of the height of t the belfry); from H to K is a plate passing from one opening to the other. The two struts I L are halved together and strongly relieve these plates. From the point M hang double inclined ties M N, which support the end of the horizontal timber N O resting on the sill of the opening; horizontal putlogs P stiffen the entire internal system and have their outer ends pinched by the great inclined ties M N, form as many scaffolds for the masons. Thus before the tower was erected, the suspended scaffold could be built. The structure being carried up to the level of the plates H K, we set on posts G other posts G′, other plates R S, struts T V, then double ties X, that a again suspend the ends of the first plates ind the intermediate scaffolds. One notes that the second plates R S and the struts T pass through the stone spire in holes purposely arranged, closed later or left visible. From dormers on the four faces of the spire, parallel to those of the tower pass timbers as brackets to prevent the vibration of the scaffold. The eight openings of the belfry thus permit scaffolds to project beyond the construction, on which can be placed platforms. T There remain the angle scaffolds. For this we have the great middle post a b, and rest c at the reentrant angle, and a hole

reserved at d on the diagonal of the square (see sketch J on the diagonal of the plan); that suffices. The plates e f passing through those holes rest on the posts G and the central post, and are relieved by the large struts i l; two hinging ties n o suspend the intermediate platforms. Attaining the level e f, we find the continuation of the middle part of the posts G; we assemble the second plate p q, the struts r s that relieve it and pass through the dormers of the spire; we arrange the hanging ties t v, and connect these diagonal timbers with the parallel ones by means of horizontal beams, which at different heights extend entirely around the spire. T The construction being finished, all these scaffolds are easily removed through the interior.

To see these arrangements still existing on the exteriors of great edifices of the middle ages, it is certain that suspended scaffolds were much used then. During the 14 th and 15 th centuries the monuments of an earlier epoch were much repaired, either because their surfaces were injured, or because it was desired to place them in harmony with the new forms. I In the case of removals or of external restorations, these sc scaffolds were very useful because they did not obstruct the ground story, and cost far less than scaffolds rising from t the ground. The carpenters established a series of principal platforms (7) by means of beams A fixed in the masonry, whose overhang was supported by great struts B and by suspended ties C. If the space required between the frames was too great to place simple beams between them, hanging frames D were placed from one beam to the other, whose arrangement is detailed in the perspective sketch (8). The ends a b are set in the wall; the suspended ties are indicated by M; the trussed beams at E. Planks P resting on these beams form the principal scaffolds on which the materials could be placed. According to the method employed by the carpenters of the middle ages the ties were fastened by means of wooden keys, without any need of bolts and ironwork. In sacffolds as in all structures of that epoch, men sought to economize materials, and did not take into account the workmanship. In our time we see scaffolds simply and solidly combined; yet it must be stated, that architects too readily abandon the direction of that accessory yecessary to every important structure; a little study and attention on

their part would avoid much useless expense, and due to the deplorable system of settlements, we are often compelled to employ carpentry contractors unable to find the best means to build stable scaffolds by useing little wood. But a wall made scaffold is one of the parts of the art of the constructor, t that best emphasizes his intelligence and his good direction. One can judge the real science of the constructor by the manner in which he arranges his scaffolds. Well built scaffolds save time for workmen, give them confidence, lead them to greater regularity, system and care; if they are massive, they use wood proberly, the workmen know how to recognize this perfectly; they judge by this temporary work the degree of the practical knowledge of their chief, and have no liking for that abuse of means. If on the contrary, masons are called to work on bold scaffolds, apparently light, but which some days of testing suffice to prove their stability, they very quickly appreciate these qualities, and understand that in the work required from them is care and accuracy, that men will not be content with "nearly so." In the restoration of ancient edifices, the scaffolds require from the architect great fertility in combinations; one cannot devote too much attention to this study; economy, order in the work, and more than all, the lives of the workmen depend on it.

ECHAUGUETTE. Watchtower. Turret. Watch Turret.

In the middle ages this word denoted a Sentinel. (Old French poem). 1, 2. Also the guard or post. (Old French poem).[3] Men used it for guarding and watching. (Old French poem). 4

Note 1.p.114. Roman de Rou. Verse 9549 et seq.

Note 2.p.114. Roman de Garin le Loherain. The form "eschauguite" is preferable, and is employed in the same privince. (old French poem). This word is formed from Scoura, interpreted in the monuments of the 8 th century by turma, acies, and by wachte, guard. Scaraguayta.

Note 3.p.114. Roman d'Ogier l'Ardenois. Verse 1122 et seq.

Note 4. The same. Verse 10736.

During the 14 th, 15 th and 16 th centuries in north France, the little cells intended for sentinels on towers and curtains are called indifferently by names given in the text.[5] Thus the post takes the name of the sort of man enclosed.

Note 5. p. 114. Archives of Bethune, peronne, Noyon. Les artistes du nord de la France aux 14^e, 15^e et 16^e siecles, by Al. de la Fons, baron Melicoco. Bethune. 1848. -- Repairs of the fortifications of Bethune, Arras, Grise, Noyon, Peronne, etc. Registre des comptes, p. 185 et seq.

In the most ancient fortifocations of the middle ages were wacth boxes. It is to be believed that those first watch boxes were of wood, like defensive galleries, and that they were set up in time of war. All the tops of fortresses preceding the 12 th century being destroyed, we cannot give an idea of the exact form of these primitive watch boxes, whether they did not consist merely of little wooden boxes, but if they were constructed of masonry, they were only little square or cylindrical turrets crowning the angles of the principal defenses, like those that we have shown at the top of the keep of the castle of Arques. (Art. Donjon, Figs. 7, 8, 9). The first permanent watch boxes of which examples are found, are not earlier than the 12 th century, then they were lavished on the d defenses; they are either closed, covered and even furnished with fireplaces; or they only present a projection at an angle or along a curtain, so as to offer a small flanking turret to facilitate oversight, to place a sentinel or watch. It was especially in the vicinity of gates, at the angles of great works, at the tops of keeps, that were constructed watch turrets.

We see four beautiful watch turrets crowning the keep of Pr Provins (Art. Donjon, Fig. 27 et seq.); these were covered a and each could contain but one man. Sometimes the watch turret is a little closed post capable of containing two or three soldiers, like the upper guard. At the top of the keep of Chambo exists one of these watch turrets of the 13 th century, above the stair tower of the 12 th.

Here (1) is the internal appearance of this post, which could contain four men. It is vaulted and is surmounted by a te terrace formerly with battlements. A little window looking o out on the country lights it, a fireplace permits warming it; on the right of the fireplace is a shelf intended to receive a lamp. The men of the post could easily ascend to the upper terrace to observe what passed at a distance. These great turrets in two stories are quite common; it is to be believed t that in time of war the soldiers sheltered in the covered story

were placed as sentries in turn on the upper terrace. On the two sides of the tower of Tresau at Carcassonne we see likewise two high turrets thus combined; only it was necessary from the closed story to mount on the terrace by a ladder, passing through a hole made in the middle of the little vault. (Art. Construction, Fig. 154).

It is always necessary to distinguish watch turrets only i intended for oversight at a distance, from those rising at t the same time for watch and defense. Keeps always possessed at least one watch turret, on the top of which was a sentinel by day and night, who by sounding a horn warned the garrison in case of a surprise, an unusual movement outside, or a fire; who announced the rising of the sun, curfew, the return of a body of soldiers, the arrival of strangers, the departure and the return from the chase; "the night having been slept through, and when he heard the sentinel sound the day, he rose a and went to the church to praw God to aid him."[1] This sort of watch box consisted of a turret dominating the vicinity above the battlements and roofs. Certain keeps by their location a alone, like the keep of castle Gaillard and that of Coucy had no need of watch turrets; their upper defense took their places; but keeps composed of several lodgings connected together, like the keep of Arques and much later that of Pierrefonds, for example, must necessarily possess a watch turret. In the castle of Carcassonne, which dates from the beginning of the 12 th century, the watch turre is a spacial tower with rectangular plan, containing stairs with a terrace and battlements on top. That tower dominates all the defenses of the castle and even those of the city; it encloses for about two thirds its height a little post lighted by a window looking out on the country. (Art. Architecture Militaire, Figs. 12, 13). Watch turrets only intended for observation offer notheng special, they are turrets, square, polygonal or most frequently cylindrical, that terminate stairways above the principal towers of castles, much exceeding the level of the crests of the highest roofs. Watch towers serving to contain a post or even one sentinel able at need to act for the defense of a place, on the contrary are very interesting to study, their arrangements being much varied according to the places they occupy.

About the end of the 13 th century, the gates are customari-

customarily furnished with watch turrets corbelled at the an-
gles of the building; [illegible]
turrets at the same time served for the sentinels and for fl-
anking. The beautiful gate at Prague in Bohemia, that defend-
ed the old bridge thrown over the Moldau, on the site of the old
city, is furnished at the four angles with corbelled watch tur-
rets, whose appearance is presented here.(2). They start from
a column surmounted by a broad capital with sculptured corbel;
on this fresh place are two little columns. (See plan 4) leav-
ing between them an opening purely ornamental, at the height
of the upper battlements is a watch turret also pierced by o
openings. This work dates from the middle of the 14 th cen-
tury; it is in perfect preservation and built of stone. H
ere the turrets are as much an ornament as a defense; w
[illegible]
but about the beginning of the 14 th century had a character
purely defensive, the upper turret was in two stories and ope-
ned with loopholes properly arranged to enfilade the
front of the walls and protect the angles.

Note 1.0.11. [illegible]

Note 1.0.17. If we give the example here, this is because
it seems to us to be the work of an architect from France.
Indeed in Bohemia during the 14 th century, men had recourse
to architects from our country. Thus the choir of the cathed-
ral of Prague was built in 1344 by a Frenchman, Matthew of A
rras, called to Bohemia by King John and his son Charles, m
arquess of Moravia. Among the heraldic shields that decorate
the gate on the old bridge is found the shield of France sem-
ed by fleurs-de-lis without number, and consequently older
than Charles V.

Note 2.0.17. This gate, which retains traces of the bolts
of the [illegible] of 1848, was destroyed
some years since without any serious reason. It was a curi-
ous work.

If the flanking watch turrets were placed beside the gates,
for a stronger reason they were placed at the projecting ang-
les formed by the curtains, when any reason prevented the flan-
king of these angles by a round tower. For example, it h
appened that the nature of the ground did not permit the er-
ection of a tower suitable in diameter; or instead that the n

customarily furnished with watch turrets corbelled at the angles of the building above the entrance.(Art. Porte). These t turrets at the same time served for the sentinels and for flanking. The beautiful gate at Prague in Bohemia, that defends the old bridge thrown over the Moldau, on the side of the old city, is furnished at the four angles with charming watch turrets, whose appearance is presented here.(2). They start from a column surmounted by a broad capital with sculptured corbel; on this first slab are set little columns. (See plan A) leaving between them an opening purely ornamental, at the height of the upper battlements is a watch turret also pierced by o openings.[1] This work dates from the middle of the 14 th century, it is in perfect preservation and built of sandstone. B But here the turrets are as much an ornament as a defense; w while those flanking the gate of Notre Dame at Sens (3), erected about the beginning of the 14 th century had a character purely defensive, the upper turret was in two stories and presented slits and openings properly arranged to enfilade the front of the gates and protect the angle.[2]

Note 1.p.118. La Chronique de Reims. Chap. 8.

Note 1.p.118. If we give this example here, this is because it seems to us to be the work of an architect from Picardy. Indeed in Bohemia during the 14 th century, men had recourse to architects from our country. Thus the choir of the cathedral of Prague was built in 1344 by a Frenchman, Matthew of A Arras, called to Bohemia by king John and his son Charles, m margrave of Moravia. Among the heraldic shields that decorate the gate on the old bridge is found the shield of France spotted by fleurs-de-lis without number, and consequently older than Charles V.

Note 2.p.118. This gate, which retains traces of the balls of the allied armies in the invasion of 1814, was destroyed s some years since without any serious reason. It was a charming ruin.

If the flanking watch turrets were placed beside the gates, for a stronger reason they were placed at the projecting angles formed by the curtains, when any reason prevented the finishing of these angles with a round tower. For example, it o occurred that the nature of the ground did not permit the erection of a tower suitable in diameter; or indeed that the m

military architects desired to make a rectangular projection, either to mask a postern or to flank a front, yet without encumbering the place by a tower, that might injure the safety of the defense. Thus for example, on the southeast front of the external enclosure of the city of carcassonne there exists a redan A (4), suggested by the presence of a great cylindrical advanced work K, called the tower of Papegay, that was erected at that point, at the apex of a very obtuse angle, to command both the outside at G and the interior of the lists (the space left between the tow enclosures) at L, beyond the rectangular projection. Consequently is was not necessary to erect at the angle C of the rectangular projection a tower, t that would have obstructed the covered way B; yet it was essential to protect the front B, the flank A and the salient a angle itself. They built therefore at that angle a large watch turret, that sufficed to protect the salient angle, but co could not injure the command of the great tower K.

Fig. 5 reproduces the external view of that turret,[3] whose battlements were a little higher than those of the adjacent curtains. In time of war that work could be equipped with defensive galleries, which much increased its strength. Between gate Narbonne and the tower of Tresau of the same city was t thus placed a redan, that enfilades the entrance and the barbican raised before that gate; this redan is surmounted by a beautiful turret. A long flanking slot is opened at its summit.

Note 3.p.118. This watch turret dates from the 13 th century.

Fig. 6 presents at A the plan of the redan at the level of the ground of the city, with its little post E and the slot F looking toward the gate Narbonne. From this post E by a screw stairs is reached the turret (plan B), which is only the battlements of the curtain forming an oblique flanking corbelled out on the angle C. The section C made on the line O P of the plan B explains the construction of this turret, which could be equipped with defensive galleries like the curtains, at D we have represented the section of the corbelling H.

Until the 14 th century, flanking watch turrets placed on the curtains are always only accidental, and are not connected with a general system of defense; while after that epoch we see these turrets adopted regularly, either to supplement the towers, or to defend the curtains between two towers. But this

fact compels us to make some explanations.

From the Roman epoch until the 12 th century, it was admitt-ed that a place was much stronger when its towers were near together, and we have seen that at the end of the 12 th cent-ury again, Richard Lionheart in building castle Gaillard, com-posed its last defense of a series of towers or segments of c circles almost in contact. When in the 13 th century casting machines had been perfected, and men had at command hand cr-ossbows of a longer range, as a result they must leave a grea-ter distance between the towers, and thus increasing the fron-ts, place flankings in proportion to their extent, i.e., give the towers a greater diameter, to be able to place therein a greater number of defenders. If it was an advantage to make the fronts longer, there was an inconvenience in much enlarg-ing the diameter of the towers, for that gave protection to the assailants in a great number of cases, as for example, w when they succeeded in getting near the wall between two tow-ers, and had destroyed the upper defenses. Every system carr-ies with it the defects inherent in its qualities themselves. Since the casting machines had a longer reach, it was necess-ary to extend the fronts as much as possible, yet one could not neglect the flanking, for if the assailants reached the f foot of the curtain, these became necessahy; now the more for-midable the flankings, the less the fronts could render ser-vice for a distant defense.

Let (7) a front A B be furnished with towers; B C is the w width of the ditch; the reach of the crossbow is E F. If the assailant arranged his attack according to the line F G H, n nine embrasures covered it. But let I K be a continuous front not flanked by towers, the attack being arranged just as here at F G H, the embrasures being also pierced at distances equ-al to those of the front A B, 13 of these embrasures could c cover the assailants. When he passed the ditch and posted him-self at M, the besieged could only defend themselves by the machicolations placed directly over the point M; but they saw at a greater distance the nature of the operations of the ene-my, and disturbed him by sorties in the bottom of the ditch, where he found no protection.

When a place was regularly besieged at the end of the 13 th centurw,(Art. Siege), two towers were usually attacked, only

to stop their fire as now said, by dismantling their upper d defenses, and a breach was made by sap in the curtain between these two towers; for these being made powerless, their mass protected the assailants by covering his flanks. At the time of the definite use of stone machicolations instead of wooden galleries about the beginning of the 14 th century, there was evidently a reaction against the defensive system of the front courts; towers were spaced farther apart, the fronts were enlarged between them, and to protect these fronts without lessening their qualities, they were finished with turrets P, as indicated by the sketch N O, Fig. 7. This new system was especially applied in the defenses of the city of Avignon erected at the same epoch. These defenses must have always been quite weak, but with regard to the small relief of the curtains, an excellent system of lanking turrets has been devised, and the weakness of the defense does not result from the new mode adopted, which had the result of compelling the assailant to be-begin his siege works at a greater distance from the place. Duguesclin in brusquely treating assault always, decided against the system of great fronts flanked only by widely spaled towers, the turrets were strong enough to prevent vigorous scaling; thus this was renounced about the end of the 14 th century to return to closer towers, and especially to increase greatly the relief of the curtains. Let us then examine these watch turrets of the papal walls at Avignon.

Fig. 8 presents the plan of one of those turrets below the machicolations; they consist only of two external buttresses A, between which is built a batter, whose utility we shall r recognize; an arch connects these two buttresses. Here (9) at A is the external elevation of this work and at B its section. The turret rises much above the curtain; like that at its top it is equipped with fine machicilations of stone on its front and its two sides; further, as shown by the section, at the right of the wall forming the back between the buttresses is arranged a second machicolation C, like a slot about 10 ins. wide. If the assailant presented himself before the turret, he received vertically the projectiles cast through the visible machicolations D, and obliquely those dropped through t the second masked machicolations C; for one will observe that, due to the slope E, the stone balls dropped from this second

machicolation must nebessarily rebound on that slope F, and strike the assailants at a certain distance from the foot of the turret at the bottom of the ditch. The two buttresses, t the space between them and the slope were then a defense by rebound, arranged to firce the assailant to withdraw from the foot of the rampart, and so receding, to present himself to the shots of the crossbow men occupying the covered way of t the curtain. These turrets flank the curtains, as shown by t the upper plans (10, 10 bis). They also permit a small post t to keep under cover inside beneath the gallery G, and to appear instantly on the upper covered way H at the first call of the sentinel.

Note 1.p.125. The plon 10 is token ot the level of the poropet of the covered woy of the curtoin; plon 10 bis is ot the poropet of the wocth turret.

The internal perspective view (11) illustrates the arrangement of the little covered post, that intercepts the passage at the level of the covered way of the curtain; it explains the steps ascending to the platform of the turret, and gives an account of the construction of the work. Let us not forget to mention the presence of the corbels A placed thus in the interior of the rampart to receive a beam supporting the joists of the floor, whose other side rested on inside posts, in order to increase the width of the covered way in time of war, either to facilitate communication or to place projectiles or establish machines. We have explained elsewhere the utility of these additional covered ways. (Art. Architecture Cilitaire. Figs. 32, 33).

This sort of watch turret interrupting a passage on the curtains, like the touers had the advantage of obliging the rounds to have themselves recognized, either by the sentinel placed at the top of the work or by the post sheltered beneath the little upper platform. Sometimes even these turrets were closed, completely barring the covered way, and they are actual guard rooms. We still see a turret of this kind on the western curtain of the fortress of Villeneuve-les-Avignon. This turret does not flank the curtain, and scarcely projects beyond its external surface' it is reserved for the service of the garrison. Here is its plan (12). At A is the covered way interrupted by the turret and its two doors B; a sin-

single opening C has a view of the exterior; at D is a small fireplace. Two or three men at most could remain in this post presented here (13) in its internal appearance, assuming the roof sketched at E to be removed. This part of the walls of the citadel of Villeneuve-les-Avignon dates from the first h half of the 14 th century.

The forms given to watch turrets during the 14 th and 15 th centuries are much varied; when they serve for flanking, they are rectangular like those of Avignon, semicircular or polygonal, supported on buttresses, on corbelling or corbels, according to the need or the nature of the defenses; they are covered or uncovered, containing one or several stories of openings, with or without machicolations.

There still existed in 1835 at the top of the ramparts of t the abbey of Mt. S. Michel-en-Mer, at the south side, a beautiful turret with machicolations on the front and sides, like that of Villeneuve-les-Avignon, interrupting communication on the covered way of the curtain. That turret belonged to the structures of the 14 th century.[1]

Note 1.p.128. Since that epoch, the portion of the rampart in question has been restored and the turret was destroyed; long since it served as privies.

The plan (14) taken at the level of the openings shows the two openings closing the turret, the little fireplace that s served to warm the watch, the opening of the front machicolations at A, and those of the side at B. These machicolations were closed by means of h nged flaps.

Fig. 15 gives an external perspective view of this post with its roof. This structure was of red granite.

Fig. 15 bis presents at A the section of the turret on the line E G, and at B on the line C D of the plan.

In the first of these sections is indicated the opening of the front cachicolation at H with the projection K from the face of the wall to prevent arrows shot from below from slipping along the surface to the defenders. In the second section B is seen the opening of the front machicolation at L, and at M. Those of the side machicolations with the stops O for arrows coming from outside. These lateral machicolations with t the slots P served to flank the curtains, for one will note that the defenders could not only drop stones vertically, but

also shoot crossbow bolts obliquely, as indicated by the dotted line M N. One finds quite frequently in our ancient fortresses many turrets arranged in this manner, at least for front machicolations, but one should not take for them the privies that have the same appearance externally, and discharge o outside (Art. Latrine), when that exterior is a ditch or precipice.

As we shall have occasion to state many times in this Dictionary, the architects of the 13 th, 14 th and 15 th centuries always employed corbellings when this system of construction could be useful to them; it often happens in structures, that one is obliged to give the upper parts more area than the lower part of the masonry. The architects of the middle ages were subject to these requirements, they did not hesitate to e employ the system of corbelling, and they skilfully evaded t the resulting difficulties, while obtaining perfectly stable structures.

On one of the fronts of the castle of Vez (see general plan of the castle in Art. Donjon, Fig. 45), there exist still beautiful semicircular flanking turrets, of which we give an e external perspective view (16). On the batter of the curtain starts a buttress, rectangular and slightly projecting, that by means of three little corbels bears a lower semicircular cylinder on which are placed four moulded courses forming a strong corbelling, that supports the turret. The overhang of that mass is perfectly maintained by the mass of the curtain. On the other front of the same enclosure, inside the court of castle exist turrets here rectangular with double flankings, i.e., forming two projections at each side (17), intended to flank the curtain at right and left; the first projection is sufficiently great to allow shooting parallel to the surface of that curtain; the second is less but sufficient for oblique fire, as indicated by the plan A. Here again is a wide r rectangular buttress starting from the lower batter and separating the corbelling of the first projection, then the second buttress itself corbelled and bearing the offset of the second projection. Drips protect the mouldings and prevent rain from running down the surfaces.

In military architecture watch turrets were abandoned only after Vauban. They were regarded as useful, even with artillery,

during the 16 th and 17 th centuries; the projecting angles [illegible] intended to shelter the sentinels. It is unnecessary to state that in case of siege this was the first thing battered by the assailants. This persistence of the watch turret only proved its importance in the military works of the middle ages, since it was so difficult to abandon it, even after the entire system of defense was transformed. The last watch turrets are in the form of [illegible] boxes, very narrow and borne on a [illegible] and [illegible] for watching the outside, but not serving for defense. Yet at the beginning of the 15 th century, and at the moment when was already established covered ramparts outside the ancient enclosures, when these bulwarks present a salient angle (which is rare, the circular form being then accepted), this salient angle is sometimes furnished with a quite large turret, set diagonally on the angle of the rampart, as indicated by Fig. 15. These turrets could receive a falconet; they were ordinarily roofed by stone slabs placed on a vault, decorated by heraldic shields and other ornaments, that gave to the salients of the ramparts a certain monumental appearance. Time and [illegible] have left few traces of these little works, that we find only in old engravings; we scarcely perceive now on our old [illegible] bastions only some courses of corbellings, which supported this sort of turrets.

On the ramparts of earth and wickerwork, great use of which was made during the wars of the 16 th century to cover old fortifications, watch boxes of wood were established outside the salient angle of the bastion and at the middle of curtains (15 bis), so as to permit sentinels to see what occurred at the bottom of the ditches. This sort of watch box was employed until the 17 th century.

[illegible] turrets on the defensive galleries of fortifications of the middle ages; these turrets were connected to the defensive galleries and formed a kind of bay. (Art. Bretèche). As for permanent wooden watch turrets, we have scrupulously destroyed them in France. Hardly may we perceive their traces on some towers. To find this sort of work still entire, it is necessary to desire to pass the Rhine and travel over conservative Germany.

during the 16 th and 17 th centuries; the projecting angles of bastions still bore turrets for two hundred years, only intended to shelter the sentinels. It is unnecessary to state that in case of siege this was the first thing battered by the assailants. This persistence of the watch turret only proved its importance in the military works of the middle ages, since it was so difficult to abandon it, even after the entire system of defense was transformed. The last watch turrets are in the form of pepper boxes, very narrow and borne on a corbel and having only the value of a watch box, i.e., only good for watching the outside, but not serving for defense. Yet at the beginning of the 16 th century, and at the moment when men already established covered ramparts outside the ancient enclosures, when these bulwarks present a salient angle (which is rare, the circular form being then acceptedU, this salient angle is sometimes furnished with a quite large turret, set diagonally on the angle of the rampart, as indicated by Fig. 18. These turrets could receive a falconet, they were ordinarily roofed by stone slabs placed on a vault, decorated by heraldic shields and other ornaments, that gave to the salients of the ramparts a certain monumental appearance. Time and balls have left few traces of these little works, that we find only in old engravings; we scarcely perceive now on our old French bastions only some courses of corbellings, which supported this sort of turrets.

On the ramparts of earth and wickerwork, great use of which was made during the wars of the 16 th century to cover old fortifocations, watch boxes of wood were established outside the salient angle of the bastion and at the middle of curtains (18 bis), so as to permit sentinels to see what occurred at the bottom of the ditches. This sort of watch box was employed untel in the 17 th century.

Men also established temporary wooden turrets on the defensive galleries of fortifications of the middle ages; these tu turrets were connected to the defensive galleries and formed a kind of bay.(Art. Breteche). As for permanent wooden watch turrets, we have scrupulously destroyed them in France. Hardly may we perceive their traces on some towers. To find this sort of work still entire, it is necessary to decide to pass the Rhine and travel over conservative Germany.

On the eastery border of Lake Constance is a charming little city named Lindau; it is at the end of a Bavarian railway. lindau has respected its mediaeval walls with some old flanking towers. One of these towers, whose construction dates in the 14 th century, is crowned by four wooden turrets of the 15 th century resting on stone corbels. Here (19) is that entire structure. The roofs are covered by glazed tiles with b balls and weathercocks of gilded copper. Since the 15 th century no profane hand has touched that innocent defense except to maintain it; no municipal council has claimed that the wood of the roof was decayed, or that the tower obstructed pedestrians. We give (20) the detail of one of these four turrets, whose wooden framework is paneled with masonry, with slots on each face. It suffices to cast the eyes on the engravings of Israel Sylvestre, Merian and Chastillon, to prove that all c cities of the North and East contained numbers of these towers crowned by watch turrets, that outlined themselves so well a against the sky, to give the cities a picturesque appearance. Today we are reduced to admire these remains of the past in G Germany, Belgium or in England.

In the country and especially in the plain country, the roofs of the towers of castles were furnished wit turrets, that allowed one to see what occurred afar; Picardy and Flanders surmounted the roofs of their keeps by wooden watch turrets covered with lead or slates. The engravings have preserved to us some of these wooden watch boxes. We give here (21) one of them at A.[1] At the base of the gable are seen two other stone turrets B in two stories, flanking the covered way of the machicolations.

Note 1.p.136. From the castle of BBesel in Brabant. (Castello et praetorio ect. Antwerp. 1696.

We again find the tradition of these turrets crowning the roofs of towers in most chateaus of the Renaissance at Chambord, Tanlay, Ancy-le-France, and later at the chateau of Richelieu in Poitou, Blerancourt in Picardy, etc. It was only under the reign of Louis XIV, and when the steep roofs were no longer placed on the public or private buildings, that there disappeared the last remains of the watch towers of the feudal castles.

Roofs of city belfries were often furnished with wooden turrets. Like the roofs of keeps, men took great care to destroy

them with us and it is necessary for us to have recourse always to old engravings, if we desire to obtain an idea of their arrangement. Most belfry towers of cities of northern France were square, erected in the 13 th and 14 th centuries;[1] they were terminated by a gallery, covered or open to the sky, with turrets at the angles; further, the carpentry roof, generally very high and ornate (for the cities attached a sort of glory to the possession of a magnificent belfry), was pierced by lanterns or turrets, serving as boxes for the watchmen. It is indeed again necessary to borrow from the country beyond the Rhine, to assist our descriptions of these monuments. Let us then return to Prague, the city of watch turrets, whose G Gothic architecture most nearly approaches our school of Picardy.

Note 1.p.132. The belfries of Amiens, Bethune and Valenciennes, that exist now or existed a few years since, are built on a square plan. (Art. Beffroi).

The parish church located opposite the city hall possesses two towers on its western facade, whose tops rather assume the form of our municipal belfries of the north than that of a c church tower. These towers in the lack of other existing data, will serve us in restoring the watch turrets of the city halls of the 14 th and 15 th centuries.

On a last square story (22) expands a wide corbelling decorated by shields of arms, at the four angles this corbelling forms portions of an octagon, as indicated by the plan A. A stone balustrade extends around it and is surmounted at the angles by turrets also of stone and covered by acute pyramidal roofs of wood. Recessed and on the internal surface of the tower rises a great roof with eight sides, on four of which are placed wooden watch turrets also covered by octagonal pyramids. All these roofs are covered by slates and lead, with rods, balls and weathercocks. Four little diagonal roofs allow one to pass under cover from the base of the carpentry into each angle turret.

Fig. 23 gives the detail of one of the four upper turrets of the roof. A crown of this kind, but probably more sumptuous, must have terminated the belfry of the city of Amiens, built about 1440 and burned in 1562. A watchman had charge of the t top of this belfry, to sound the bells to announce the banishment of some criminal, fires that appeared in the city or sub-

suburbs, to give the alarm if he saw a troop of men at arms [illegible] at the gates. The different sounds of the ringing of the bells informed the inhabitants of the motive for which they were called. That watchman in the 15 th century received as pay one crown of forty sous per year, and a coat of cloth half red and half blue, that he wore because of the "great winds and frost in the said high belfry." He looked in the tower, must play its "little piece" at the morning ringing; he blew a horn on account of the citizens assembled outside the city on the occasion of some ceremony or festival, that they could be at peace, and that nothing injurious occurred within the city. It was necessary for him to play certain airs when processions circulated in the city.[1] One will agree, that he was a man that earned well his crown of forty sous (?) and a red and blue coat per year.

Note 1.p.151. Desc. du beffroi de l'hotel de ville d'Amiens, by M. Dusevel. *Amiens.* 1837.

[illegible] sieged the terrible ages, and those castles [illegible] surrounded by buttresses, so there were placed the watch turrets. One may yet see on the western facade of the abbey church of S. Denis traces of circular watch turrets built in the 15 th century on the buttresses of the 12 th. During the wars with the English under Charles VI and Charles VII in Normandy, on the frontiers of Brittany and on the banks of the Loire, many abbey churches were thus equipped with watch turrets. In the provinces exposed to the raids of adventurers, in mountains and desert places, the churches were almost always fortified externally so as to be able to defend themselves from a troop of brigands. The turrets then served not only for watching vagabonds by day and by night, but they also flanked the walls and commanded the approaches. The abbey church of S. Claude in the Jura, now a cathedral, built toward the end of the 14 th century, bears on its buttresses turrets well enclosed and commanding perfectly the portals. These turrets (21) are one story and covered on the side buttresses, two stories (25) on the angle buttresses. One passes from one of these stories to the other by a trap placed in the floor and a little miller's ladder. In the south of France the towers on fortified churches

suburbs, to give the alarm if he saw a troop of men at arms advancing toward the city, and to warn the sentinels placed at the gates. The different sounds of the ringing of the bells informed the inhabitants of the motive for which they were called. That watchman in the 15 th century received as pay o one crown of forty sous per year, and a coat of cloth half red and half blue, that he wore because of the"great winds and f frost in the said high belfry." He lodged in the tower, must play his "little pipe" at the morning ringing; be blew a horn to announce to the citizens assembled outside the city on the occasion of some ceremony or festival, that they could be at peace, and that nothing injurious occurred within the city. It was necessary for him to play certain airs when processions circulated in the city.[1] One will agree, that he was a man that earned well the crown of forty sous ($1) and a red and blue c coat per year.

Note 1.p.141. Desc. du boffroi de l'hotel de ville d'Amiens, by M. Dusevel. Amiens. 1847.

Certain monasteries and certain churches were fortified during the middle ages, and these churches being usually surrounded by buttresses, on these were placed the watch turrets. One may yet see on the western facade of the abbey church of S. Denis traces of circular watch turrets built in the 15 th century on the buttresses of the 12 th. During the wars with the English under Charles VI and Charles VII in Normandy, on the frontiers of Brittany and on the banks of the Loire, many abbey churches were thus equipped with watch turrets. In the provinces exposed to the raids of adventurers, in mountains and desert places, the churches were almost always rebuilt externally so as to be able to defend themselves from a troop of brigands. The turrets then served not only for posting watchmen by day and by night, but they also flanked the walls and commanded the approaches. The abbey church of S. Claude in the Jura, now a cathedral, built toward the end of the 14 th century, bears on its buttresses turrets well enclosed and commanding perfectly the outside. These turrets (24) are one story and covered on the side buttresses, two stories (25) on the angle buttresses. One passes from one of these stories to the other by a trap placed in the floor and a little miller's ladder. In the south of France one notes on Romanesque churches

turrets built in haste in the 14 th century to put these edifices in condition to resist raids of the troops of the Black Prince. men also built turrets on religious edifices to receive small guns.

From the day that everyone no longer thought of his personal defense, the watch turret disappeared from our civil or religious edifices, and it must be recognized that the police of our times replaces with advantage those little posts of oversight.

ECHELLE. Scale. Proportion.

We do not speak of the ladder (echelle) used by workmen to ascend on scaffolds, nor of the permanent ladders on places reserved for executions, to which were fastened persons convicted of perjury or of some shameful crime, to leave them thus exposed to the sorry jokes of the crown.[1] We only occupy ourselves with the relative scale. In architecture one says of t the scale of a monument. "That edifice is out of scale." The scale of a dog is the dog, i.e., that it is proper for that h hut to be in proportion to the animal it is to contain. A dog hut into which an ass could enter and lie down would not be in scale.

Note 1.p.143. See the curious relief found at the base of t the south portal of Notre Dame of Paris, which represents a student fastened to a ladder; other students surround and seem to scoff at him. On the breast of the criminal is fixed a small square tablet on which are inscribed the letters P.FAUS. S for perjury.

This principle that appears so natural and so simple at first sight, is however one of those on which the different schools of architecture (of our time) understand least. We have already touched on this question in Art. Architecture, and o our lamented colleague, M. Lassus, had treated it before us.[2] Yet in practice, it does not appear that observations previously made on this subject have produced results. We have not the vanity to be surprised at this; we simply believe that o our explanations have neither been sufficiently extended nor clear enough. It is necessary to resume the question and to treat it thoroughly, for it is worth the trouble.

Note 2.p.143. Ann. arch. of M.Didron. Vol.1.

The Greeks in their architecture adopted the module, which cannot be doubted, they do not seem to have had scale. Thus whether a Greek order had 16.4 or 32.8 ft. in height, the harmonic rations are the same in one as in the other, i.e., for example, that if the diameter of the column at the base is o one, the height of the column will be six, and the intercolumniation one and a half at the middle of the shaft, in the small as in the large order. In a word, the dimension does not change the relative proportions of the different members of the order. Yet the Greeks were provided with a sense so delicate, that one can scarcely admit in them the nonapplication of a true principle in the matter of art, without a major cause. We are ignorant of the harmonic mechanism of Grecian architecture, we can only state its results without having so far discovered its formulas. We indeed recognize, that there exists a module, different tonalities, mathematical rules, but we do not possess the key, and Vitruvius can aid us little in this, for he himself does not seem to have been initiated into the formulas of Grecian architecture of the best time, a and what he has said on the subject of the orders is not in accord with the examples left by his masters. Let us then leave this problem to be solved, observing only the appearance. If we consider only the two architectures, mothers of the arts of the middle ages, i.e., Grecian and Roman architectures, we find in the former a complete art, all in one piece, consistent, formulated, in which the appearance is in accord with t the principle; in the second a construction often independent of the appearance, the need and the art, the object and its decoration. The need being manifested in Roman architecture, being imperious even habitually, and the need relating to man, the pure harmony of Greek art is destroyed, scale already appears in Roman edifices; it becomes imperious in architecture of the middle ages. Likewise in antique society the individual is nothing, only the sport of destiny, lost in public affairs, so that he cannot exert an influence on the form or proportions of the monuments that he erects. A temple is a temple; it is great, if the city can make it great; it is small, if its purpose or penury of resources requires it to be small; if it be great, there is a great doorway; if it be small, there is only a little doorway. Impossibilities resulting from

the nature of the materials alone place a limit to the dimen- sions of the great monument, just as the necessity of passing through a doorway alone prevents it from being below the hu- man height; but it certainly did not occur to the mind of a Greek to place his edifice in relation with himself as a man, than to suppose that his will could modify the degrees of beau- ty. The harmonic relations existing between the members of a Greek order are so fully determined by the art and not by the object, for example, a portico of Doric columns having a stairs to be erected on a platform composed of courses reced- ing behind each other like steps, the height of these steps having to be in harmonic relation to the diameter of the col- ums, if the diameter of these columns be such, that each step has the height of an ordinary step, it is so much the better for the ease of those desirous to enter beneath the portico. But if the diameter of these columns is much greater the har- monic height of the step will increase in proportion; it will become impossible for human legs to climb them, and since af- ter all it is necessary to ascend, one made in even these co- urses steps at certain points, as a concession made by art to human needs, [illegible] with [illegible], as the necessity. Evident- ly the Greek considered his temple rather as a law than as a measure. With him architecture only obeyed its own laws. That is certainly very fine, but it can only exist in the midst of society like Greek society, in which cultures, reasons, love and the preservation of the beautiful were the principal mat- [illegible] our edifices as a scale. Besides it is unnecessary to hope to be able at the same time to satisfy the [illegible] two opposed principles. When in a city the public and private edifices a are all erected according to a proper harmony, belonging to the architecture itself, there is established between these [illegible] of very different dimensions and relations, that accor- d [illegible] give to the eyes pleasure, that a well written symphony gives to the hearing. The eye easily detects the dimensions when the proportions are the same, and one conceives very well that a Greek would experience as much pleasure in seeing a [illegible] Doric order established according to harmonic rules, as a [illegible]; that he would not be shocked by seeing the little and the great beside each other, when one is shocked by seeing

the nature of the materials alone place a limit to the dimensions of the great monument, just as the necessity of passing through a doorway alone prevents it from being below the human height; but it certainly did not occur to the mind of a Greek to place his edifice in relation with himself as a man, than to suppose that his will could modify the decrees of destiny. The harmonic relations existing between the members of a Grecian order are so fully determined by the art and not th the object, for example, a portico of Doric columns having a always to be erected on a platform composed of courses receding behind each other like steps, the height of these steps having to be in harmonic relation to the diameter of the columns, id the diameter of these columns be such, that each step has the height of an ordinary rise, it is so much the better for the legs of those desiring tn enter beneath the portico. But if the diameter of these columns is much greater the harmonic height of the step will increase in proportion; it will become impossible for human legs to clear them, and since after all it is necessary to ascend, men made in even these courses steps at certain points, as a concession made by art to human needs, but made with regret, as one perceives. Evidently the Greek regarded art matters rather as a lover than as a master. With him architecture only obeyed its own laws. That is certainly very fine, but it can only exist in the midst of society like Greek society, in which culture, respect, love and the preservation od the beautiful were the principal matters. We must either return to those favorable times, or make our edifices at a scale. Besides it is unnecessary to hope to be able at the same time to sacrifice to these two opposed p principles. When in a city the public and private edifices a are all erected according to a proper harmony, belonging to the architecture itself, there is established between these works of very different dimensions and relations, that probably give to the eyes pleasure, that a well written symphony g gives to the hearing. The eye easily neglects the dimensions when the proportions are the same, and one conceives very well, that a Greek would experience as much pleasure in seeing a l little order established according to harmonic rules , as a great one; that he would not be shocked by seeing the little and the great besied each other, than one is shocked by hearing

a melody sung by a soprano and a baritone. Perhaps even the Greeks established in relations between the dimensions the harmonic relateons, that we recognize between voices an octave apart. May the monuments intended to be seen together have been composed by antiphonies? We can well believe that the Gr Greeks were capable of anything in the matter of art, that th they experienced by the sense of sight enjoyments, that we a are too rude to ever know.

The Greek method was lost, and the Romans did not comprehend it. Instead of those harmonic principles based on the abstract modules, the middle ages put forth another principle, that of scale, i.e., than in place of the module varying according to the dimensions of edifices, it takes a uniform measure, and that uniform measure is first given by the height of man, then by the nature of the material employed. These new principles (we say new, for we see them applied nowhere in antiquity), do not cause, that because man is small, all monuments will be small; they are limited, even in the most immense edifices, (and the middle ages did not commit the fault of erecting such), to compel the architect to recall always the dimensions of man, to take into account always the dimensions of the materials that he employs.

Henceforth a doorway will not increase in proportion to the edifice, for the door is made for man, it will retain the scale of its purpose; a step will always be a practicable riser. The height of man (it is well understood, that we select among the smaller) is divided into six parts, which are divided into twelve, for the duodecimal system, which is divisible into halves, fourths and thirds, is first accepted as the most complete. Man is a fathom, the sixth of man is the foot, the twelfth of a foor is the inch. Provided with that measure, the architects proceed to subordinate to it all the members of their edifices; then man becomes the module, and this module is invariable. That does not mean that the architecture of the middle ages, at its origin and its climax may be a simple calculation, a numerical formula; no, this principle is limited to recalling always the human height. Thus whatever be the he height of a pier, the base of that pier never exceeds the height of the window sill; whatever the height of the facade, t the height of the doorways will not exceed two fathoms, or t

two and a half at most, because one does not suppose that men and what they can carry, such as banners, canopies, rods, could exceed that height. Whatever the height of the nave, the service galleries with different stories will be proportioned, not to the size of the edofice, but to the height of man. Now for certain principal members. Let us enter further into the theory. Men have been very far to seek the origin of engaged columns, which in monuments of the middle ages extend indefinitely, whatever their diameter, contrary to the Greek system; yet there was need only to refer to the principle of the scale adopted by the architects of those times to find the reason of that innovation. Men have denied to us the influence of the human scale, saying to us for example, that the engaged columns of the piers of the cathedral of Rheims are much larger than those of a village church; we reply that the engaged columns of the cathedral of Rheims are not in proportional relation wit the engaged columns of an edifice of one fourth the size. That is a matter of geometry.

Let us take a monument frankly Gothic, the principal nave of the cathedral of Amiens. That nave is 47.6 ft. between axes of piers; the central columns are 4.5 ft. diameter, and t the four little columns engaged to the central column are 1.5 ft. We demand that there be indicated to us a nave of the same epoch with only 23.8 ft. between axes, whose central columns are only 2.2 ft. diameter with engaged columns 0.7 ft., i.e., being in exact ratio to the proportions of the nave of the c cathedral of Amiens.

Here is a monument that presents itself opportunely, constructed of very resistant materials, while those composing the c cathedral of Amiens are but moderately so; this is the nave of the church of Semur-in-Auxois, built at the same time as t that of the cathedral of Amiens. The nave has a width of 20.6 ft, . little less than half the former. Now the central columns are 3.5 ft. diameter, the columns engaged to them are 0.8 ft. instead of 2.1 aud 0.6 ft. Those proportional ratios found in antique architecture then do not exist here; note that 0.405 makes just 17.7 ins, and 0.27 is 10.6 ins, and the little columns engaged to the piers of the church of Semur-in-Auxois a are the slenderest of that epoch known to us; ordinarily tho- little columns, that have such great importance because they

apparently support the principal members of the architecture in the sammlest edifices are 1.05 ft, in the largest 1.31 ft.; in the exceptional one at Rheims, 1.6 ft.;[1] i.e., 1, $1 + \frac{1}{4}$, $1 + \frac{1}{2}$. But what gives the scale of an edifice are rather measures in height than measures in width. Now in that little church of Semur, the level of the top of the bases is 3.5 ft. above the floor, and these piers are only 16.4 ft. high including the capital, to the impost of the vaults of the side a aisles. In the cathedral of Amiens, the piers that fulfil the smae purpose are 45.3 ft., and the level of the top of the bases is 3.5 ft. high. In the cathedral of Rheims, the piers a are 36.7 ft. high, and the bases are 4.3 ft.; i.e., $3\frac{1}{4}$ and 4 units. The capitals of these piers of the nawe of Amiens including everything are 3.7 ft. high; those of Rheims are 3.7 ft.; those of the little church of Semur are 3.2 ft., same as the bases. The nave of the cathedral of Rheims is 121.4 ft. under the crown; the little columns of its triforium are 11.5 ft. high. The nave of the cathedral of Amiens is 137.8 ft. beneath the crown, the columns of its triforium are 9.8 ft. high. The nave of the church of Semur is 78.7 ft. under the crown; the little columns of its triforium are 6.6 ft. high; that is the minimum, since the triforium is a serwice passage, which indicates the presence of man; thus it does not increase in proportion to the dimensions of the edefice. On the contrary even when as at Amiens the construction compels the architects to give the triforium a greater height beneath its ceiling, they recall the human dimensions by an important and very visible detail, such as the little columns. It is for that, that at the base of edifices, in the interiors and below the great windows, the architects take care to attach arcades, whatever the dimensions of the edifices, which are not only borne by little columns of 6.6 ft. height at most, little columns that are thus entirely around the monument at the height of the e eye, as multiplied means of recalling the human scale, and th that in a most striking fashion, that these columns always r rest on a bench, which is well understood to be made as a seat, and only has a height suitable for that purpose, i.e., from 15.7 to 17.7 ins. It is unnecessary to state that balustrades and window sills, whatever the dimensions of the edifices, ha have only the necessary height, i.e., 3.3 ft.

Note 1.p.147. In the architecture of Champagne of the 13 th century, the columns are of much greater diameter, then in t the school of Ile-de-Brance. The most slender are found in t the Burgundian school, and that is by the extraordinary resestance of the materials of that province.

Not only the height of man, but also the dimensions of the materials determine the scale of Roman, and particularly that of Gothic architecture. Every architectural member must be c cut in the height of one course; but since building stones do not everywhere have the same height of bed, that is where is recognized the flexibility of the principles of this architecture. With a tact and art feeling very little appreciated in our days, the architect of the middle ages built his construction so as to place it in accord with the dimensions of the edifice that he erected. It matters little that the materials are high or low, he knows how at the same time to submit himself to the scale imposed by these materials anf to the proportions suitable for a great or a little monument. Let us assume that he possesses only limestones with height of bed of 1.3 ft. at most, and that he desires to build an edifice of very great dimensions, for example like the cathedral of Paris; let us even admit that he holds to giving this facade grand proportions, or better said, a scale superior to the common scale; He will build the substructures in regular low courses; if in these substructures he desiers to have bands project, he will only give these bands a small height, and again he will cut on them fine and deficate mouldings, to leave to the lower mass all its importance; he will maintain the horizontal lines as better indicating the stability. Reaching a certain height, he feels it necessary to avoid the uniformity suited to a substructure, that the horizontal beds produced by the courses will destroy the effect of the vertical lines. T Then before that constructiou composed of courses he places l little columns set on end, whimh are like an architectured design independent of the construction; he places on these little columns arches cut in stones likewise set on edge, and bonded to that one does not perceive the structural joints, t thus he gives to his architecture the proportions that suit him, and he leaves to these proportions the more grandeur, in that behind this ornamental facing the eye recovers the true

scale of the structure, that given by the dimensions of the materials. The great open gallery, just below the towers, terminates the facade of Notre Dame of Paris, is a masterpiece of that kind. The true construction, like an unvarying theme, continues from top to bottom by regular courses of about 1.3 ft. high. Before the uniform mass is first placed in a gallery of the kings with its monolithic columns 9.5 ins. diameter, spaced between statues 2.8 ft. high. Then comes immediately a [illegible] which re-unites to the gallery its interest by recalling the height of a man near these colossal figures. Above are horizontal courses, the same continuous with nothing to change the [illegible] whose monolithic columns are 16.7 ft. high and 7. ins. diameter, crowned by arches and a projecting cornice, rich and severe, in which however the ornamentation and the mouldings are suited to the dimensions of the materials. (Arch. Gothique, Fig. 17). The towers rise on that vast substructure; as all know, they are composed of piers with little engaged columns built in courses 1.3 ft. high, and so well that even at that distance all see the construction. There is an absence only of columns at the angles, each of these courses bearing a con- [illegible] against the wall of the [illegible]. These little series of ornaments thus mark the scale of the construction, and relate to the towers their actual dimensions by showing not only [illegible]. On the facade of Notre Dame of Paris, the scale given by the height of a man and by the nature of the materials is thus constantly observed from base to summit. The gallery serves as a mark for comparison, but that exists only in the lower parts; the upper ones are without it, and the architect has proceeded wisely; for on an edifice of this height, if one places statues at the top, they will seem too small, when they do not exceed at least twice the height of man; they become the architecture when they are colossal. In entering a church or a Gothic hall, each one is inclined to believe these interiors much greater than they actually are; it is again by a judicious application of this principle of the human scale, that this result is obtained. As we have just stated, the bases of piers, their capitals, the little columns of the upper galleries remain at different heights

scale of the structure, that given by the dimensions of the materials. The great open gallery, that below the towers terminates the facade of Notre Dame of Paris, is a masterpiece of that kind. The true construction, like an unvarying theme, continues from top to bottom by regular courses of about 1.3 ft. high. Before the uniform mass is first placed the gallery of the kings with its monolithic columns 9.8 ins. diameter, placed between statues 9.8 ft. high. Then comes immediately a balustrade at the human scale, i.e., about 3.3 ft. high, which restores to the gallery its grandeur by recalling the height of a man near those colossal figures. Above are horizontal courses, the theme continues with nothing to change the effect. The work terminates with that great vertical gallery, whose monolithic columns are 16.7 ft. high and 7.0 ins. diameter, crowned by arches and a projecting cornice, high and strong, in which however the ornamentation and the mouldings are subject to the dimensions of the materials. (Art. Corniche, Fig. 17). The towers rise on that vast substructure; as all know, they are composed of piers with little engaged columns built in courses 1.5 ft. high; but so that the eye at that distance can see the construction, there is an enormous pile of courses at the angles, each of these courses bearing a crocket and outlined against the wall or the sky. Those long series of crockets thus mark the scale of the construction, and restore to the towers their actual dimensions by showing how many courses compose them. On the facade of Notre Dame of Paris, the scale given by the height of a man and by the nature of the materials is then carefully observed from base to ridge. The statuary serves as a point for comparison, but doors exist only in the lower parts; the upper ones are without it, and the architect has proceeded wisely; for on an edifice of this height, if one places statues at the top, they will appear too small, when they do not exceed at least twice the height of man; they crush the architecture when they are colossal.

On entering a church or a Gothic hall, each one is disposed to believe these interiors much greater than they actually are; it is again by a judicious application of this principle of the human scale, that this result is obtained. As we have just stated, the bases of piers, their capitals, the little columns of the upper galleries recall at different heights

the stature of man, whatever are the proportions of the monument. Further, the multiplicity of the vertical lines singularly adds to the height. In these interiors the mouldings are flat and delicate, always cut in courses lower than those of the piers or walls. The spaces in the tracery of the windows never exceed the width of an ordinary opening, say at most 4.1 ft. If the windows are very wide, the mullions are multiplied and always recall these dimensions to which the eye is accustomed, and cause in effect that these wiydows have their actual width. Besides these openings are filled with glass panels separated by iron bars, which agin contribute to give the glazed openings their true size; and to return to the indefinitely elongated engaged columns, in the use of which some see a decadence or rather a forgetting of the rules of antiquity for the orders, others the influence of a foreign art, and s still others the product of chance, they are only the result of a principle, that has no relation to the principles of antique architecture. First it is necessary to admit that the Greek orders exist no lonber, because in fact they have no r reason to exist among a people, that entirely abandons the l lintel for the arch. The lintel being no longer accepted, the point of support is no longer a column but a pier. The column supporteng a lintel is and should be diminished, i.e., should present at its base a wider section than at its capital; this ir first a need of the eye and also a law of statics; for the lintel being an inert body, it is necessary for the support on which this weight rests should present a perfect stability. On the contrary the arch is an active load, that can only be maintained by an opposing force. Four arches rest on a pier and reciprocally abut each other, and the pier is only a resistance opposed to the resultant of these opposed forces. It w will never come into the mind of an architect (we mean an architect that constructs) to place four arches on a conical or pyramidal pier. He will turn them from a cylinder or prism, since he knows that the resultant of the oblique pressures of these four arches, if equal in diameter, depth and loading, p passes along the axis of this prism without deviation. He can content himself with a pointed strut set on its point to carry these arches. Now as we have sufficiently emphasized in Art. Construction, the system of vaults and of arches adopted in

the middle does nothing but a system of equilibrium of forces opposed to each other by abutments or loads. All in that system of construction tends to resolve itself into vertical pressures, and the system of equilibrium being adopted, since it is necessary to increase everything and even to exag- [illegible] in execution, since it is necessary to count on errors in the estimation of the oblique pressures or loads, and consequently on deviations in the vertical resultants, better in that case is a pier lending itself to those deviations, than a pier inflexible on its base. Indeed let a pier A [illegible] then be the resultant of the pressures, which instead of being perfectly vertical may be oblique according to the line C D, and this resultant will tend to give place to the pier the movement indicated at E. Then the pier will be [illegible] at its base. But on the contrary if on a pier B be an oblique resultant of pressures, the pier will tend to rock on its base so that this resultant will return to the vertical as proved by the sketch F. Then if the pier be loaded, this movement can have no serious inconveniences. All can make this experiment upon a cone on the vertex on the base of which is placed the finger. In the first case the base will be moved from the horizontal plane; in the second the cone will follow, and unless the centre of gravity leaves the conical surface, one will feel under the pressure a resistance always sufficiently stable. So let us leave then the productions of the Romans of the various orders, which have nothing to do with the system of construction of the evolution of the middle ages. Let us compare opposed methods by their first principles. The [illegible] and even the Renaissance architects of the [illegible] did not know the column, properly speaking, they know only the [illegible]. When the architecture [illegible] itself, when pier was decomposed into as many members as there were arches to support; certainly the unity is more logical. These members have to receive [illegible] members or nearly so; then by reason of the [illegible] of the [illegible], they give to each one the proper diameter, 1.05, 1.21 or 1.60 ft., as we have proved above; that is also very [illegible]. They placed [illegible] on a single base; [illegible] and window sills, are made for them and not for monuments; that, does not conform to the antique system, but it is still

the middle ages being nothing but a system of equilibrium of forces opposed to each other by abutments or loads, all in that system of architecture tends to resolve itself into vertical pressures, and the system of equilibrium being adopted, since it is necessary to foresee everything and even imperfection in execution, since it is necessary to count on errors in the estimation of the oblique pressures or loads, and consequently on deviations in the vertical resultants, better in that case is a pier lending itself to those deviations, than a pier inflexible on its base. Indeed let a pier A (1) then be the resultant of the pressures, which instead of being or- perfectly vertical may be oblique according to the line C D, and this resultant will tend to give place to the pier the movement indicated at B. Then the pier will be flushed at its edges. But on the contrary if on a pier E be an oblique resultant of pressures, the pier will tend to rock on its base so that this resultant will return to the vertical as proved by the sketch F. Then if the pier be loaded, this covement can have no serious inconvenience. All can make this experiment with a cone on the vertex on the base of which is placed the finger. In the first case the base will be moved from the horizontal plane; in the second the cone will follow, and unless the centre of gravity leaves the conical surface, one will f feel under the pressure a resistance always sufficiently strong. So let us leave then the proportions of the locumn of t the antique orders, which have nothing to do with the system of construction of the architecture of the middle ages. Let us compare opposed methods by their similar principles. The Gothic and even the Romanesque architects of the north did not k know the column, properly speaking, they knew only the pier. When the architecture perfected itself, that pier was decomposed into as many members as there were arches to support; certainly nothing is more logical. These members have to receive equal members or nearly so; then by reason of the extent of t the monuments, they give to each one the proper diameter, 1.05, 1.31 or 1.60 ft., as we have proved above; that is also very logical. They placed these combined members on a single base, not made for them but for man, just as the doors, balustrades, steps and window sills, are made for man and not for monuments; that does not conform to the antique system, but it is still

according to logic, for these are not edifices that enter their own doors, ascend their own steps, or lean on their own balustrades, but indeed men do so. These members or parts of piers, these supports have, one an arch support 16.4 ft. above the ground; it is stopped at that height and its capital is set (which is merely a corbel proper to receive the impost of the arch) (Art. chapiteau); another must carry its arch at 26.3 ft. above the ground; in its turn it stops at that level; the last will receive its load at 49.2 ft., and its capital will be placed at that height. That is neither Greek nor even Roman, but it is always perfectly logical. The engaged Gothic column, which is thus lengthened or shortened according to t the height of the load it must carry, has no moduce, but it has its scale, which is its diameter; it is cylindrical and not conical, because it indicates only a support receiving a load acting in its axis, and that assuming even a deviation in the resultant of the pressures, it is less dangerous to the stability of the edifice, that it can incline as a post would do, than if it had a large bearing opposing that movement. Its diameter isas little variable as possible, whatever the dimensions of the edifice, because thes uniform diameter, to which the eye accustoms itself, appearing slender in a vast monument and large in a little one, thus indicates the actual dimension, and serves as a scale, in a word, like the bases, arcades, b balustrades, etc.

But since the architects of the middle ages have the manifest desire to make the interiors of monuments seem great (which is not an evil), they carefully avoid all that could injure that greatness. Thus they avoid placing statues in these interiors, unless in the lower parts, and then they only give them human dimensions at most. The idea of placing colossal figures beneath a vault or ceiling never came in their minds, because they were architects, they loved architecture and did not allow the other arts to destroy the effect it should produce. Sculpturs were no longer unfortunate or less skilful in making statuary to the scale; they found their account in it, and architecture cound its own. (Art. Statuaire).

How from a point of departure so true and logical, so according to the invariable principles of all art; how from that e exquisite sense of the artist subjecting himself to a rigoro-

rigorous law without weakening the expression of his personal genius, man came to erect in a city, a centre of refined and intelligent schools, a monument like the arch of triumph of the star, i.e., out of scale with all surrounding it, a portal through which would pass a frigate with its masts, a monument whose principal merit is to make the grandest promenade in Eu-Europe appear a thicket of shrubs; it must be that the sense of sight has been strangely falsified among us, and that by a long series of abuses in the matter of art, we have lost all feeling for the true. Already more than a century since, president De Brosses,[1] speaking of his first visit to the basilica of S. Peter of Rome, says that in the interior that vast edifice neither seemed to him gread nor small, high or low, wide or narrow. He adds; "one perceives its enormous extent only by proportion, when one considers a chapel it is found as great as a cathedral; in measuring a grotesque figure there at the foot of the column; one finds a thumb as large as the wrist. That admirable edifice by the admirable correctness of its proportions has the property of reducing colossal things to their proper value. What a happy property!" To erect colossal edifices so that they may appear only of ordinary dimensions, to make statues of infants 9.8 ft. high seem to be of ordinary size! Yet president De Brosses is a man of sense, very intelligent and art-loving; his letters are full of very correct appreciations. It is because that since him has been repeated that judgment of the terrible amateur, making a bad compliment to S. Peter of Rome. One could say as much of our arch of triumph of the star and of some other modern monuments; "The arch of the star by the admirable correctness of its proportions, only appears like an ordinary gateway; it has the property of reducing all around it to such small dimensions, that the avenue of the Champs Elysees seems to be a path bordered by hedges, and the carriages traversing it are ants passing about their affairs along a line of sand." If this be the aim of art, Mt. Blanc is the despair of architects, for they will never s succeed in erecting an edifice, that has that degree of merit to reduce to nothing all that surrounds it. In the city where we exert ourselves to erect public buildings, that recall in nothing the human scale, open windows so out of proportion to the services they are intended to light, which it is necessary

to cut into two or foud parts by floors and partitions, so t that the rooms receive light as indicated by the adjacent illustration (2), which is neither beautiful nor convenient; w when we crown our cornices of these edifices by dormers with which one would make a facade suitable for habitation; in that same city, let us say, are imposed on us (and the council may be praised for it!) dimensions for heights of our houses and of their stories. The reason of the public desires men to restrict themselves within the limits imposed by good sense and salubrity, when this cincerns private edifices. Here is what is no longer entirely according to logic, for the public edifices (or we are singularly mistaken) are made for men as well as houses, and we do not become twice or thrice as large when we enter them. Whn then are these edifices out of scale with us, with our needs and our habits? That is more majestic, says one. But the facade of Notre Dame is sufficiently majestic, and it is at the scale of our human weakness, it is great and appears so, but the houses surrounding it are always houses and not cages for mice, because on the facade of Notre Dame, however great it is, the architects took care to recall from top to bottom that human scale, that lowest scale which we desire indeed, but of which we are not the authors.

Note 1.p.152. Lettres fomillieres ecrites d'Itolie en 1740, by C. De Brosses. Vol. 92. p. 3.

ECHIFFRE, MUR D'. Stair String Wall.

This is the wall on which rest the steps of a stairs, when this wall does not exceed the levels of the projecting steps. (Art. Escalier).

ECOLE. Style or School of Architecture.

During the middle ages there were on the area of France of our days several schools, either during the Romanesque epoch or in the Gothic period. The Romanesque schools mostly came f from the monastic establishments, some like the Romanesque s school of Ile-de-Franc and Normandy, belonged to the political organization of those provinces; others like the schools of Provence and of a part of Languedoc,are only the expression of Roman municipilaties, which in those provinces continued until the epoch of the war of the Albigenses; these last

schools more than any other followed the traditions of antique architecture. Others still like the schools of Perigord, Saintonge, Angoumois and a part of Poitou, about the 11 th c century suffered the influences of Byzantine art. In our provinces are only counted four schools during the Gothic period; the school of Ile-de-France, Soissonais and Beauvoisois; the school of Burgundy, the school of Champagne, and the Norman school. (See for explanations, Arts. Architecture Religieuse, Architecture Militaire, cathedrale, Clocher, Construction, E Eglise, peinture, Sculpture, Statuaire).

ECU. Shield. (See Art. Armoires).

EGLISE PERSONIFIEE. Church personified.

SYNAGOGUE PERSONIFIEE. Synagogue personified.

About the beginning of the 13 th century, the constructors of our cathedsals, conforming to the spirit of the time, desired to trace on the portals of those great edifices both religious and civil, not only the history of the world, but everything connected with the creation and the knowledge of man, his good and bad tendencies. (Art. Cathedrale). In carving on the voussoirs of these portals and the vast recesses of these doorways the scenes of the old and New Testaments, however t they claimed to indicate to the multitude of believers the d distinction to be established between the new and the old law; that is why in a visible place on these facades they placed two statues of women, one holding a standard that broke in her hands, having a reversed crown at her feet, allowing tablets to fall, bowing her head, the eyes covered by a band or by a dragon coiled around her forehead; this is the ancient law, t the synagogue, a dethroned queen whose glory is past, blinded by the spirit of evil, or at least incapable of knowing the eternal truths of the new law. The other statue of a woman w wears a crown on her head with raised brow; her expression is proud; she triumphs and turns to the side of the assembly of the apostles, in the midst of which stands Christ teaching; this is the new law, the Church. This beautiful programme was fulfilled in the most complete manner on the portal of the c cathedral of Paris. Tha statues of the Church and of the Synagogue were still seen at the two sides of the principal portal

at the end of the last (18 th) century, in the wide niches c cut in the faces of the buttresses; the Church on the right, of Christ surrounded by the apostles. The Synagogue on the left.[1]

Note 1.p.154. These two statues were removed in Aug. 1792. They have just been replaced.

We now possess in France only a very small number of these statues. The church of S. Seurin of Bordeaux has retained its own, as well as the cathedrals of Strasburg and of Rheims. T The Church and the Synagogue are lacking among the statues of our great and truly French cathedrals, like Chartres, Amiens and Bourges; they onln exist at Paris and Rheims. One should observe in this case that the statues of the Church and of t the Synagogue, placed parallel and occupying very visible pl-aces, are only found in the cities where existed in the middle ages a numerous Jewish population. There were few or no Jews at Chartres, Bourges or Amiens; while at Paris, Rheims and Bordeaux, in the cities of the Rhine, in Germany, Jewish fami-lies were important and were often the object of persecutions. The lower part of the facade of Notre Dame of Paris having b been built under Philip August, an enemy of the Jews, it is not surprising that in that epoch it was desired to show the multitude the state of inferiority in which was held the old law. At Bordeaux, a city tolerably peopled by Jews in the 13 th century, the statuary artists that sculptured the fegures of the south portal of S. Seurin did not limit themselves to placind a band over the eyes of the Synagogue, they surround-ed the head by a dragon (1), as the Parisian artists had done. The Synagogue of S. Seurin of Bordeaux has allowed her cross to fall at her feet; she holds only the staff of her standard and her tablets are reversed; to her girdle is attached a pur-se. Is this an emblem of the riches attributed to the Jews? At A is a detail of the head of this statue.

At the cathedral of Bamberg, whose statuary is so remarkab-le and recalls the good French schools of the 12 th and 13 th centuries more than any other in Germany, the representations of the Church and the Synagogue still exist at the two sides of the north portal; and a curious fact because perhaps conn-ected with some political act of that epoch, although this p portal may be of the 12 th century, the two statues of the old

and new law are of about 1230; further they are accompanied by accessory figures, which give a more marked signification than elsewhere.

The Synagogue of the cathedral of Bamberg (2) stands on a column to which is attached a little figure of a Jew, easily recognized by his pointed cap.[1] Above that statue is a devil, whose legs are winged; he rests on the cap of the Jew. The s statue of the old law is beautiful; its eyes are covered by a cloth band; with the left hand it allows five tablets to drop, and with the right it holds with difficulty its broken standard. No crown is seen at its feet. As a pendant at the left of the specator and consequently on the right of the portal, the Church likewise stands on a little column, the lower part of whose base is occupied by a seated figure with a scroll displayed on its knees (3); with the right hand (now mutilated), this personage seems to bless, the head is wanting, which embarrasses us a little in designating that statue, which however we believe to be Christ. Above are four evangelists, i. e., below the lion and the ox, above the eagle and the angel. Unfortunately the two arms of the new law are broken. Further, one always recognizes that it held the standard with the right hand and the chalice in the left. This statue, beautifully e executed and full of nobility, nowise affected as are already the statues of that epoch in Germany, is crowned. It is covered by a canopy, like its pendant.

Note 1.p.155. No one is ignorant, that in the middle ages in cities the Jews were obliged to wear a cap of a particular form, much resembling a funnel or a reversed suspended lamp.

The cathedral of Strasburg still preserves at the side of i its south portal, which dates from the 12 th century, two statues of the Church and of the Synagogue sculptured about the middle of the 13 th century. Thus these representations sculptured on the portals of churches appear to have been made from 1210 to 1260, i.e., during the period particularly sad for t the Jews, when they were persecuted with the most energy in the West. The Synagogue of the cathedral of Strasburg that we give (4) has its eyes covered; its standard breaks in its hand; its left arm is pendent and allows the tablets to fall. The Church (5) is a gracious figure, almost smiling, sculptured with rare delicacy in that beautiful red sandstone of the Vos-

Vosges, which takes the color of bronze.

That manner of personifying the Christian religion and the Jewish religion is not the only one. We see over the south p portal of the cathedral of Worms, in the tympanum of the gable surmounting that portal a great figure of a crowned woman, holding the chalice in the right hand as one holds a vase into which is poured a liquid. That crowned woman (6) is proudly seated on an animal with four heads, eagle, lion, ox and man; four legs, a human foot, cloven hoof, lion's paw and e eagle's talon; that is again the new law. In the tympanum of the portal below that statue is seen the coronation of the Virgin; on the voussoirs are the nativity, Noah's rainbow, A Adam and Eve, the crucifixion, the three women at the tomb, Jesus Christ resuscitated, and the prophets. Among the statues of the jambs are noted the Church and the Synagogue. The Christian religion bears the raised standard and is crowned; the Jewish religion has bandaged eyes and is slaying a goat; her crown falls at one side, her tablets at the other.

We find the extended explanation of the statue seated on t the beast with four heads in the manuscripts of Herrade of La Landsberg, the Hortus deliciarum (garden of delights), now d deposited in the library of Strasburg.[1] One of the vignettes represents Christ on the cross. Above the two arms of the cross is seen the weeping sun and moon, then the torn veils of the temple. Below are two Romans, one holding the spear, the other the sponge filled with vinegar and gall; the Virgin, S. John and the two thieves. On the first plane at the right of the Saviour is a crowned woman, like that of the Cathedral of Worms, seated on the beast, a symbol of the four gospels; she holds a cup into which falls the blood of Christ; in the left hand she bears a standard ending in a cross. On the left of the divine execution is another woman, seated on an ass, whose feet stumble in knotted cords; the woman has nude legs; a veil falls over her eyes; her right hand holds a knife, her left hand drops the tablets; on her lap lies a goat, her standard is reversed. Below the representation the dead are leaving their tombs.

Note 1.p.159. This manuscript is a sort of encyclopedia; it dates from the 12 th century. Several of its miniatures have been reproduced by us in the Dictionnaire du Mobilier Francois.

Although the sculpture of Worms dates from the middle of the 13 th century, it gives us in statuary of a beautiful style a fragment of the scene so fully drawn in the 12 th century by Herrade of Landsberg, i.e., the Church collecting the blood of the Saviour and seated on the four gospels. The woman borne by a fettered ass personifies the Synagogue, this was to treat the Old Testament with some harshness.

Frequently in our France stained glass is likewise seen a Christ on the cross with the Church and the Synagogue beside him, but represented without their animals, the Church collecting the blood of the Saviour in a chalice, and the Synagogue veiled, averted like the statues of Bamberg and of Strasburg, or holdiug a young goat that she slays. Villard of Honnecourt appears in vignette 57 od his manuscript to have copied one of the figures of the Church on stained glass and perhaps a painting of his time.

EGLISE. Church. Basilica.

Place for assembly of believers. During the middle ages churches were divided into cathedral, abbey, monastic, collegiate and parish churches.

Parish churches are found under the jurisdiction of bishops or that of abbots; thus it was for them, bishops and abbots, to govern a considerable number of parishes; hence one of the first causes of the prodigious number of parish churches erected in cities and market towns duriug the 12 th and 13 th centuries, i.e., at the epoch of the commencing struggle between the monastic and the episcopal powers. Besides the division and antagonism exist in all religious or political institutions of the middle ages, each one in the civil as in the spiritual order desires to have a distinct part. The great abbeys from the 11 th century sought to place unity in the midst of this general subdivision; but it soon bacame evident that the monastic order established that unity for its own special advantage; the episcopate recognised if soon enough to profit by the municipal development of the 12 th century, and to attract the people toward itself, either in building immense cathedrals or in rebuilding the parish churches in larger proportions, especially in cities. Indeed if we pass through the cities of France north of the Loire, we see that not only all

the cathedrals, but also the parish churches, were rebuilt du during the period comprised between 1150 and 1250. This movement was originated by the episcopate and encouraged by the s secular nobility, which saw in the abbots too powerful feudal lords, and was pussued with ardor by the urban people, among whom the church was then a mark of independence and unity. Th Thus from the 12 th to the 13 th centuries money flowed for building those great cathedrals and the parish churches grouped around them.

The abbot of the Cluniacs had formed a school, i.e., parishes dependant on them imitated as far as possible those typical monuments, in more modest proportions. It was the same for the cathedrals, when they were rebuilt at the end of the 12 th and beginning of the 13 th centuries; they served as models for the parish churches erected in the diocese. Yet it is unnecessary to believe that these little monuments were reductions of the great ones, imitation wisely restricted itself to adopting the methods of construction, the arrangements in detail, the ornamentation of certain iconographic characters of the vast abbey churches or of the cathedrals.

About the 5 th century when the new worship could be practised publicly, two principles had a marked effect in the construction of the churches of the West, the tradition of the antique basilicas, which among pagan monuments first served as places of assembly for the faithful; then the memory of t the venerable sanctuaries excavated underground, crypts that had enclosed the remains of martyrs, and in which the sacred mysteries had been practised during the days of persecution. Nothing resembles the crypt less that a Roman basilica; yet the Roman basilica had at its end opposite the entrance a s semicircle covered by a ralf dome, the tribunal. There in the first Christian churches was established the seat of the bishop or of the ministering ecclesiastic, who replaced him, around him were ranged the clerics; the altar was placed in front, at the entrance of the semicircle raised several steps. The faithful stood in the aisles, the men at one side and the women at the other. Usually our first French churches possessed under the semicircle the apse, a crypt in which was deposited the sacred body, and sometimes the end of the church itself r recalls the arrangement of these subterranean structures, al-

although the nave retains the appearance of the antique basilica. these two kinds of such opposed construction left traces long in our churches, and the sanctuaries are vaulted, built according to the solid method of Roman edifices constructed of bricks and concrete, while the naves only consist of light walls resting on rows of piers with a covering of carpentry like the antique basilicas.

We posses only very vague information on the primitive churches on the soil of France, and it is from only the 10 th c century, that we can obtain a passably accurate idea of what those edifices were; again at that epoch they presented varieties according to the provinces within which they were erected. The primitive churches of Ile-de-France do not resemble those of Auvergne; the latter nowise recall the churches of Champagne, of Normandy or of Poitou. The religious monuments of Languedoc essentially differ from those erected in Burgundy. Each province during the Romanesque period possessed its school, the result of different traditions. The Latin influence at first appears everywhere; it changes more or less, according to whether these provinces place themselves in connection with the adjacent active centres of civilization, or find within themselves the new impulses. For example, Auvergne, th that for centuries passed for one of the most backward of the provinces of France, possessed in the 11 th century a very advanced are very complete, that allowed it to build beautiful and stable churches, still standing today. Champagne, of all French provinces excepting Provence that longest retained the Latin traditions, perhaps because its territory still contained in the first centuries of the middle ages a great number o of Roman edifices. It is the same with Soissonais. In the East near the coasts of the ocean, on the contrary, we find from t the 10 th century a marked Byzantine influence in the construction of religious edifices. That Byzantine influence appears in the East along the banks of the Rhine, but it assumes a d different appearance. Having occasion in this Dictionahy many times to occupy ourselves with churches of the different parts entering into their construction (Arts. Abside, Architecture Religieuse, cathedrale, Chapelle, choeur, Clocher, Construction, Nef, Travee), we shall restrict ourselves to mentioning here the general characteristics, that can aid in classifying

churches by schools and by epochs.

FRENCH SCHOOL. One of the oldest churches of the French school, properly so called, is the Basse Oeuvre (lower work) of Beauvais, whose nave belongs to the 8 th or 9 th century. This nave is that of a Roman basilica with its side aisles. I It is composed of two walls pierced by windows with round arches, two rows of piers of square section supporting round archivolts and the upper walls likewise pierced by windows. This very simple structure was covered by visible carpentry. The a apse is now destroyed, and was probably composed of a semicircle covered by a half dome; did a transept exist? That is what we cannot say. As for the facade rebuilt in the 11 th century, it was apparently preceded originally by a portico or n narthex, according to the custom of the primitive churches. T The construction of this edifice is again evidently entirely Roman with walls of small rubble with squared faces and bands of bricks. No appearance of ornamentation, unless on the facade built later. It is unnecessary to see there the Franco-L Latin church in its rude simplicity. The walls must have been decorated in the interior by paintings, since the authors occupying themselves with the religious monuments of the Merovingians and Carlovingians, Gregory of Tours at the head, speak continually of the paintings that cowered the churches of their tome. The windows must have been closed by gratings of stone or wood in which were inserted pieces of glars or of gypsum. (Art. Fenetre). The ancient Beauvoisois still contains other churches nearly contemporaneous with the Basse Oeuvre, but smaller and without side aisles, composed only of a rectangular hall with a square or semicircular apse. These are actual barns. Such are the churches of Abbecourt, Auviller, Bailleral and Bresles.[1] Those churches were not vaulted but covered by visible carpentry. We see that tradition persists untel about the beginning of the 12 th century. The naves continue to be ceiled; the sanctuaries are generally rectangular, and alone are small and vaulted. Transepts rarely appear; but when they exist, they are very pronounced, projecting beyond the n naves for their entire width. The church of Montmille [2] is o one of the most characteristic among the latter. The nave with its side aisles was ceiled as well as the transepts. Four transverse arches over the crossing probably supported a tower;

the choir alone is vaulted.

Note 1.p.163. See Monum. de l'anc. Beauv., by M. E. Woittez. Paris. 1839.1849.

Note 2.p.163. Priory of Montmille, church of S. Maxien, 11 th century.

From the 11 th century was built at Paris the church of the priory of S. Martin-des-Champs of the order of Cluny, whose choir still exists. Already in that edifice the sanctuary is enclosed by a side aisle with radiating chapels.[1] Same arrangement in the abbey church of Morienval, which dates from the beginning of the 11 th century.

Note 1.p.164. Nearly all the high and low vaults of this c choir were rebuilt about the end of the 12 th century.

But in the 12 th century in Ile-de-France, religious architecture took a great flight. At the middle of that century a abbot Suger built the abbey church of S. Denis with numerous radiating chapels around the choir. Immediately afterwards ar arose the cathedrals of Noyon, Senlis,[2] Paris,[3] the abbey church of S. Germer, the church of S. Maclou, of Pontoise, of which there remains only some old portions of the apse, the churches of Bagneux and of Arcueil, that of the abbey of Montmartre, the little church of S. Julien-le-Pauvre at Paris, th that of Vernouillet, of Vetneuil, whose choir alone of the 1 12 th century exists, the church of Nesles, the choir of the abbey church of S. Germain-des-Pres at Paris, the churches of S. Etienne of Beauvais,[4] of S. Evremont at Creil, of S. Martin of Laon, the abbey church of S. Leu of Esserent, and the cathedral of Soissons.[5]

Note 2.p.164. In the 12 th century the cathedral of Senlis had no transept.

Note 3.p.164. All causes the supposition that the plan of the cathedral of Paris was originally conceived without a transept, like the church of Notre Dame of Mantes and the collegiate church of Poissy, also later the cathedral of Bourges.

Note 4.p.1-4. The single nave dates from the 12 th century; the choir has been rebuilt.

Note 5.p.164. This concerns only the southern transept of t that cathedral.

FRENCH CHAMPAGNE SCHOOL. This school is a derivative from the preceding; but it borrows certain characteristics from the

school of Champagne, which is more robust and retains the traditions of antique architecture. The materials of Brie have little resistance, and the constructors have taken into account their defect in solidity by giving piers and walls greater thickness, and making their edifices lower than in Ile-de-France proper.

The cathedral of Meaux still entirely belongs to the French school;[6] but the influence of the school of Champagne makes itself felt at the end of the 12 th century in the churches od S. Quiriace of Provins, Moret,[7] Nemours, Champeaux, Brie-Comte-Robert.

Note 6.p.164. The cathedral of Meaux has been modified since the end of the 12 th century, the epoch of its construction. (Art. Cathedrale).

Note 7.p.16 . The choir alone dates from the 12 th century; it is without side aisles.

CHAMPAGNE SCHOOL. This is one of the most brilliant; it develops rapidly, and it first attempts are important. The c churches of Champagne of the 10 th and 11 th centuries, like those of Ile-de-France, have naves covered by carpentry; then the sanctuaries alone were vaulted. The great abbey church of S. Remy of Rheims, of an unusual extent, was composed of a ceiled nave with double side aisles vaulted in two stories. A vast choir with side aisles and chapels in the 12 th century replaced the apses with half domes.[1] The church of Notre Dame of Chalons-sur-Marne has only carpentry over the central aisle. When in the 12 th century the choir of that church was rebuilt, vaults were erected over the nave. The important churches of lower Champagne, like those of Ile-de-France, possessed vaulted galleries over the side aisles, comprising the width of these side aisles. In the 1M th century were erected in upper Champagne churches, that approach still more the antique Roman architecture, and which are based on the Burgundian school; for example, such is the cathedral of S. Mammes at Longres, the later charming churches of Montierender, the church of Isomes and of S. Jean Baptiste at Chaumont.

Note 1.p.165. The nave of S. Remy of Rheims, which dates f from the 10 th century, was vaulted in the 12 th. These vaults were rebuilt in lath and plaster a few years since.

BURGUNDIAN SCHOOL. This originated with the Cluniacs.

From the 11 th century it rejected carpentry over the naves; it first made persistent efforts to combine the vault with the plan of the antique basilica. We have a complete example of this in the nave of the abbey church of Vezelay. In the 12 th century this school is powerful, built with large and solid materials; it took from the remains of antique edifices certain architectural details, for example, such as fluted p pilasters and cornices with modillions; it covered the ground with a great number of churches, of which we shall cite only the pr ncipal ones; first Cluny, Vezelay, Charite-sur-Loire; then the churches of Paray-le-Monial, Semur-en-Brionnais, Chateauneuf, saulieu, Beaune, S. Philibert of Dijon, Montreale, at the end of the 12 th century.

The Burgundian school abandoned Romanesque traditions with difficulty, and while were already built in Ile-de-France and lower Champagne churches presenting all the characteristics of gothic architecture, they followed in Burgundy successfully the Cluniac methods and perfected them.

AUVERGNE SCHOOL. This can pass for the most beautiful R Romanesque school; at alone from the 11 th century knew how t to erect churches entirely vaulted and perfectly stable; hence the type being found, it did not vary from it. At the end of the 11 th and during the 12 th century, there were built in t that province the church od S. Paul of Issoire, the cathedral of Puy-en-Velay, the churches of Notre Dame-du-Port (Clermont), S. Julien of Brioude, and a quantity of small monuments nearly all conceived on the same principle. This school extended at the north even to the banks of the Allier, to Ebreuil, Chatel-Montagne, Cogniat, and to Nevers in the construction of the church of S. Etienne; to the south even to Toulouse (church of S. Sernin), and as far as S. Pepoul.

POITOU SCHOOL. Very fruitful in monuments, because of the quantity and quality of the limestone, this school is lass advanced than the school of Auvergne; it possesses in a lower degree the feeling for beautiful arrangement. Like the last, it knew how to build durable vaulted churches after the 11 th century, by abutting the tunnel vaults of the great naves by those of the side aisles, but without the galleries of the second story of the churches of Auvergne, i.e., that the Rom-

Romanesque churches of Poitou are generally composed of three aisles of nearly equal height to the crown, vaulted by means of three tunnel vaults, the central one being wider than the others; while the churches of Auvergne have the side aisles c covered by cross vaults.[1] In Poitou and very early in Auvergne the sanctuaries are surrounded by a side aisle with radiating chapels, as in the church of S. Savin near Poitiers, which d dates from the 11 th century, in the upper church of Champigny. (Beginning of the 12 th century). The school of Poitou is subject to various influences. Besides the principle described above, it accepts the system of domes from the school of Saintonge and Perigord, as in the construction of the church of S. Hilaire of Poitiers, and in that of S. Radegonde with a single aisle. In the 12 th century the school of the West (Pergord and Saintonge) had such a powerful influence, that it not only stifled the school of Poitou, but it soon penetrated into Limousin and Quercy at the south, and in the north even into A Anjou and Maine.

Note 1.p.166. Architecture Religieuse, Fig. 10.

SCHOOL OF PERIGORD. Its primitive type is found at Perigueux in the old cathedral of that city, and in the abbey church of S. Front; it is a Byzantine importation.[2] The principle of this school is that of the dome supported on pendentives. In a time when most Romanesque schools in France did not well know how to solve the problem of placing the vaults on the plans of the antique basilica, that foreign importation must have had a great success. Then men abandoned in the provinces of the West during the 11 th and 12 th centuries, with rare exceptions, the Roman plan to adopt the Byzantine plan. The provinces more particularly attached to the Latin traditions, like Ile-de-France, Champagne and Burgundy, alone resisted that new influence and ppursued the solution of the problem proposed, which led them to the Gothic system of construction. Besides the two types that we have just cited, the school of Perigord presents a prodigious number of examples of c churches derived from these types. We shall limit ourselves to citing some of them; the cathedral of Cahors, the abbey church of Souillac (11 th century), that of Solignac, the cathedral of Angouleme, the church of S. Avit-Seigneur, of Vieux-Mariel, S. Jean of Cole, of Tremolac, the abbey church of Fon-

Fontevrault (12 th century), and the greater part of the little churches of Charente.

Note 2.p.166. See Architecture Byzantine en France, by M. Felix Verneilh.

NORMAN SCHOOL. Norman churches before the 12 th century were covered by visible carpentry, excepting the sanctuaries, which were vaulted by half domes. On this principle were erected the two abbey churches of S. Etienne and of S. Trinite at Caen,[1] founded by William the Bastard and Matilda his wife. These primitive arrangements are found again in a very great number of churches in England, while in France they were modified after the 12 th century; vaults replace old carpentry. The Normans were soon skilful and active constructors; so their churches of the 11 th and 12 th centuries are large, if o one compares them to the churches of Ile-de-France; the naves are longer as well as the transepts; the choirs were not enclosed by side aisles until about the middle of the 12 th century.

Note 1.p.167. In the 12 th century the naves of these churches were vaulted; the choir of the church of S. Etienne was rebuilt in the 13 th century.

These schools, diverse by their origins and works, each advance on their own part until the moment when is felt the influence of the new architecture of Ile-de-France and of Champagne, the Gothic architecture.

Gothic architecture is one of the most vivid of the expressions of the feeling of the peoples toward unity. Indeed, shortly after its birth, we see the Romanesque schools (of which we have only indicated the principal divisions) disappear, and they accept the new methods adopted by the architects of the royal domain. Yet at the beginning of the 13 th century may still be distinguished three very distinct schools; the school of Ile-de-France, which comprises the basin of the Seine between Montereau and Rouen, those of the Oise and Aisne between Laon, Noyon and Paris, the basin of the Marne between Meaux and Paris, and a part of the basin of the Somme, the C Champagne school with its seat at Rheims, and the Burgundian school with its seat at Dijon.

The Norman Gothic school only developed later, about 1260, and its true seat is in England.

The passion for building churches from 1200 to 1250 was such

north of the Loire, that not only many Romanesque monuments were destroyed to give place to new structures, but also without any reason but the love of novelty, were modified and most of the edifices were rebuilt during the 12 th century; the ca cathedrals of Paris, Senlis, Soissons, Laon, Rouen, Mans, Chartres, Bayeux, which present us with striking examples of this need of changing what had just been scarcely completed. The monasteries with more reserve followed this movement toward a renewal of architecture; as for the parishes, those that w were rich did not hesitate to pull down their old churches to construct new ones. So much so that one cannot explain how t there were found during the space of scarcely fifty years enough of building workmen, sculptors, statuaries, glass painters, to execute such a prodigious number of edifices on a territory, which scarcely comprised a third of present France. Soon even the provinces of the Centre, the East and the West followed the impulse, and these workmen spread outside the p provinces in which Gothic architecture had its birth. Although more than half the old churcher have been demolished since the end of the last (18 th) century, there still remains in France a considerable quantity of these edifices. We shall restrict ourselves to giving here a list of those, which present enough interest from the point of view of art to be placed in the r rank of historical monuments, like cathedrals, monastery or parish churches.

To facilitate researches, we shall classify these churches by Departments and Arrondisements (districts), following the alphabetical order.

AIN, department.

Arr. of Bourg;[1] church S. Andre of Bage.

Note 1.p.188. Architecture of the beginning of the 16 th c century; this church was built by the sister of Charles V; it contains beautiful stained glass and magnificent tombs. It s serves today as the chapel of the seminary.

Arr. if Nantua. Church of Nantua.[2]

Note 2. Curious church of the 12 th century, vaulted in 13 th century; style of Haute-Saone.

Arr. of Trevaux. Church S. Paul of Varax.

AISNE, department.

Arr. of Laon. Church Notre Dame of Laon (old cathedral);[3]

Church S. Martin of Laon;[4] church S. Julien of Royaucourt; ch church of Nouvion-le-Vineux; church of Marle.

Note 3.p.162. One of the most beautiful specimens of the architecture of the beginning of the 13 th century (Arts. Cathedrale, Fig. 8; Clocher, Fig. 73). At the origin the cathedral of Laon possessed a circular apse with side aisle. About 1230 that apse was demolished to be replaced by a square apse. It is difficult to account for the motives of this change. The foundations of the circular choir have been recovered by the architect, M. Boeswilwald, and the capitals forming a part of that primitive sanctuary have been replaced in the square apse. The sculpture of the cathedral of Laon is very beautiful. Villard of Honnecourt cites the towers of Laon and gives a sketch of them.

Note 4.p.162. Church of the 12 th century in a beautiful s style, with chapels in the transepts. The facade is one of t the best examples of the architecture of the 14 th century.

Arr. Chateau-Thierry. Church of Mezy-Moulins; church of Essomes; church of La Ferte-Milan.

Arr. S. Quentin. Collegiate church of S. Quentin.[5]

Note 5.p.162. church with double transepts, of the end of t the 13 th century.

Arr. Soissons. Cathedral church of Soissons;[6] abbey church of S. Medard at Soissons; abbey church of S. Jean-des-Vignes at Soissons;[1] abbey church of S. Julien, do; abbey church S. Yved of Braine.[2]

Note 6.p.162. One transept is semicircular, like those of the cathedrals of Tournay and Noyon.(Art. Architecture Religieuse, Figs. 30, 31). The choir dates from the first years of the 13 th century.(Art. Arc-Boutant, Fig. 52).

Note 1.p.169. This church in great part now destroyed, the facadewith its two towers alone exist.

Note 2.p.169. Church S. Yved of Braine is one of the most beautiful monuments of this part of France. The plan of the apse presents an excellent and rare arrangement.(See Monog. de l'Eg.abb.de Braisne, by M. Prioux. This church appears to have been constructed by the architect of the cathedral of L Laon; it dates from the beginning of the 13 th century. The facade and some bays of the nave were destroyed a few years since. The sculptures of the portal are in part deposited in

[illegible] of [illegible] [illegible] the
revolution; magnificent tombs of enameled copper, drawings of
which are now found in the collection Gaignières of the Bodle-
ian Library of Oxford.

[illegible]
-[illegible]); church of [illegible]; church of Jacquerests.

[illegible]. Department.

Arr. Moulins. Cathedral of Moulins; church of Bourbon-l'Ar-
chambault; church of S. Menoux;[2] abbey church of Souvigny;[3]
church of Veillitre; church of Toulon.

[illegible]
[illegible], restored in 9 th or 10 th century. The choir dates from
the 12 th century; it belongs to a mixed style, between that
of Auvergne and that of Burgundy.

Note 4.p.169. Great church of the 11 th and 12 th centuries,
but almost entirely rebuilt in the 15 th.

Arr. of [illegible]. Church of [illegible];[4] church of Ferreuil;[5] chur-
ch of [illegible]; church of S. [illegible];[6] church of Cosnlat;[7] ch-
urch of Vison; abbey church of Chantel.[8]

Note 5.p.169. choir of the church of Gannat is of the pure
style of Auvergne of the end of the 11 th century. The nave
was rebuilt in the 14 th; it is of a good style.

Note 6.p.169. The nave and choir of the church of Ebreuil
are of the 11 th century; the tower is of the 11 th and rests
on the narthex.

Note 7.p.169. Nave of the 11 th century, Auvergne style; a
choir of the 13 th century.

Note 8.p.169. Very pretty little church of the 12 th centu-
ry in Auvergne style; nave without aisles, with two lit-
tle apses opening into the transepts' tower over middle of t
transverse aisle.

Note 9.p.169. Pretty church in Auvergne style of the 12 th
century.

Arr. of La Palisse. Church of Chatel-Montagne.[10]

Note 10.p.169. Auvergne style, 11 th and 12 th centuries. M
magnificent porther added in 12 th century, with gallery over,
lighted from the facade; tower over transverse aisle.

Arr. of Montluçon. Church of [illegible]; church of Verize.

[illegible]

Arr. of Digne. Church of Notre Dame at Digne(cathedral); ch

the museum of Soissons. Church S. Yved constructed before the revolution; magnificent tombs of enameled copper, drawings of which are now found in the collection Goignerès of the Bodleian library of Oxford.

Arr. Vervins. Church of Aubenton; church S. Michael (near Hirson); church of Esqueheries; church of Vacqueresse.

ALLIER, department.

Arr. Moulins. Cathedral of Moulins; church of Bourbon-l'Archimbault; church of S. Menoux;[3] abbey church of Souvigny;[4] church of Meilliers; church of Toulon.

Note 3.p.169. Church with nave formerly covered by carpentry, restored in 9 th or 10 th century. The choir dates from the 12 th century; it belongs to a mixed style, between that of Auvergne and that of Burgundy.

Note 4.p.169. Great church of the 11 th and 12 th centuries, but almost entirely rebuilt in the 15 th.

Arr. of Gannat. Church of Gannat;[5] church of Ebreuil;[6] church of Biozat; church of S. Pourcain;[7] church of Cogniat;[8] church of Vicq; abbey church of Chantel.[9]

Note 5.p.169. choir of the church of Gannat is of the pure style of Auvergne of the end of the 11 th century. The nave was rebuilt in the 14 th; it is of a good style.

Note 6.p.169. The nave and choir of the church of Ebreuil are of the 11 th century; the tower is of the 12 th and rests on the narthex.

Note 7.p.169. Nave of the 11 th century, Auvergne style; c choir of the 13 th century.

Note 8.p.169. Very pretty little church of the 12 th century in Auvergne style; nave without side aisles, with two little apses opening into the transepts; tower over middle of t transverse aisle.

Note 9.p.169. Pretty church in Auvergne style of the 12 th century.

Arr. of La Palisse. Church of Chatel-Montagne.[10]

Note 10.p.169. Auvergne style, 11 th and 12 th centuries. M Magnificent narthex added in 12 th century, with gallery over, lighted from the facade; tower over transverse aisle.

Arr. of Montlucon. Church of Huriel; church of Neris.

ALPES BASSES, department.

Arr. of Digne. Church of Notre Dame at Digne(cathedral); ch

church of Seyne.

Arr. of Barcilonette. Church of Allos.

Arr. of Castellane. Old cathedral of Senez.

Arr. of Forcalquier. Church of Manosque.

Arr. of Sisteron. Church of Sisteron.

ALPES HAUTES, department.

Arr. of Gap. Church of Lagrand.

Arr. of Embrun. Old cathedral of Embrun.

ARDECHE department.

Arr. of Privas. Church of Bourg S. Andeol; church of Cruas; cathedral church of Viviers.[1]

Note 1.p.170. choir of 14 th century, without side aisles.

Arr. of Argentiere. Church of Thines.

Arr. of champagne. church of Champagne.

ARDENNES department.

Arr. of Braux. Church of Braux.

Arr. of Retnel. Church S. Nicolas of Rethel.

Arr. if Sedan. Church of Monzon.[2]

Note 2.p.170. Beautiful plan of the 13 th century.

Arr. of Vouziers. Church of Vouziers; church of Bouilly; church of Verpel; abbey church of Althigny, church of S. Vaux-bourg.

ARIEGE, department.

Arr. of Foix. Church of Unac.

Arr. of S. Gisors. Church of S. Lizier.[3]

Note 3.p.170. Church without side aisles, with a choir and two chapels in the transepts; beautiful plan of the 12 th century; cloister.

Arr. of Pamiers. Church of Roque; church of Mirepoix.

AUBE, department.

Arr. of Troyes. church of S. Peter (cathedral);[4] church of S. Urbain of Troyes;[5] church of the Madelaine, do.;[6] church of S. Andre, do.; church of S. Jean, do.; church of S. Nizier, do; church of S. Pantaleon, do.; church of S. Gilles;[7] church of Berulle; church of Montieramy.

Note 4.p.170. Choir of the 13 th century, nave of 14 th and 15 th, facade of 1. th; choir one of the largest in France; i its architecture strongely recalls that of the choir of the abbey church of S. Denis; it still retainr all its stained g glass, which is magnificent.

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[illegible]

last years of the 11 th century, is the most remarkable ex-
le of the Gothic style of Champagne at its first development.
(Arch. construction, figs 102 to 106). The nave has remained
unfinished. This church is small, its cross without side ais-
les, it should possess three towers, one on the transept cr-
ossing and the two others on the facade.

Note 2.p.170. Remains of a charming cloister of the end of the
12 th century; [illegible] of the [illegible].

Note 1.p.170. Little very timber church of the end of the 1
2 th century.

Arr. of [illegible]. Church of [illegible]; church of
[illegible].

Arr. of [illegible]. Church of [illegible]; church of [illegible]; church of [illegible].

Arr. of [illegible]. Church of [illegible]; church of [illegible]; church of [illegible]; church of [illegible].

Note 2.p.170. Nave [illegible], choir of the 12 th century.

[illegible]

Arr. of [illegible]. Old cathedral of [illegible]; [illegible]; church of [illegible]; church of [illegible].

[illegible], one of the most remarkable edifices of the [illegible] of France; nave dates from the 12 th century, choir and [illegible] from the [illegible] of the 14 th (first ogival style,

[illegible]

[illegible] from the 11 th century, remains of cornices of the same [illegible].

Note 1.p.171. Circular church of the end of the 11 th century.

Arr. of [illegible]. Old cathedral of [illegible].

Note 2.p.171. Vestiges of the Romanesque style of the 11 th cen-
tury [illegible].

Arr. of [illegible]. Old cathedral of [illegible]; abbey church of [illegible] of [illegible].

Arr. of [illegible]. Old cathedral of [illegible]; church of [illegible]; abbey church of [illegible].

Note [illegible].p.171. Remains of the cornices of the 11 th century [illegible].

[illegible]

Note 5. p.170. Church S. Urbain of Troyes, built during the last years of the 13 th century, is the most remarkable example of the Gothic style of Champagne at its final development. (Art. construction, Figs 102 to 106). The nave has remained unfinished. This church is small, its choir without side aisle, but should possess three towers, one on the transverse aisle and the two others on the facade.

Note 6.p.170. Remains of a charming church of the end of the 12 th century; rood screen of the 16 th.

Note 7.p.170. Little half timber church of the end of the 1 14 th century.

Arr. of Arcis-sur-Aube. Church of Arcis-sur-Aube; church of Vitre.

Arr. of Bar-sur-Aube. Churlh of S. Maclou at Bar-sur-Awbe; Church of S. Pierre, do.; church of Rosnay.

Arr. of Bar-sur-Seine. Church of Foucheres;[8] church of Mussy-sur-Seine; church of Ricey-Bas; church of Rumilly-les-Vaudes; church of Chaource.

Note 8.p.170. Nave Romanesque, choir of the 13 th century.

AUDE, department.

Arr. of Carcassonne. Old cathedral of S. Nazaire of Carcassonne;[9] church of S. Michel of lower city at do.; (present cathedral); church of Rieux-Minervois;[1] church of S. Vincent of Montreal.

Note 9.p.170. One of the most remarkable edifices of the s south of France; nave dates from the 11 th century, choir and transepts from the beginning of the 14 th (Arts cathedrale, Fig. 48; construction, Figs. 109 to 114); magnificent stained glass from the 14 th century, remains of paintings of the same epoch.

Note 1.p.171. Circular church of the end of the 11 th century.

Arr. of Castelnaudry. Old cathedral of S. Papoul.[2]

Note 2.p.171. Vestiges of the Auvergne style of the 11 th c century in the apse.

Arr. of Limoux. Old cathedral of Alet; abbey church of S. H Hilaire at Limoux.

Arr. of Narbonne. Old cathedral of Narbonne;[3] church of S. Paul, do.;[4] abbey church of Fontfroide.[5]

Note 3.p.171. Erected at the beginning of the 14 th century, choir alone completed. (Art. cathedrale, Fig. 48).

Note 4.p.171. Choir of the 12 th century with side aisles and radiating chapels; triforium over the chapels in the height of the side aisle. Edifice much mutilated today, but presenting an unique arrangement.

Note 5.p.171. Cistercian church of the end of the 12 th century; nave with pointed tunnel vault, side aisles with half tunnel vaults.

AVEYRON, department.

Arr. of Rodez. Catnedral of Rodez; abbey church of S. Foi a at Conques;[6]

Note 6.p.171. Great church of the 12 th century with side aisles and transepts; side aisles around choir; three apsidal chapels and four eastern apses on transepts. Stylle much recalling that if church S. Sernin of Toulouse, nave with round tunnel vault, with galleries in the second story, whose half tunnel vaults abut the thrust of the central tunnel vault, dome of tower over middle of the crossing; narthex.

Arr. of Espalion. Church of Perse.

Arr. of S. Afrique. Abbey church of Belmont.

Arr. of Villefranche. Abben church of Villefranche.

BOUCHES-DU-RHONE, department.

Arr. of Marseilles. Abbe: church of S. Victor at Marseilles;[7]

Note 7.1.171. Fortified abbey church, 11 th, 12 th and 13 th centuries.

Arr. of Aix. Cathedral church of Aix, church S. Jean at Aix; abbey church of Silvacane;[8] church S. Laurent at Salon.

Note 8.p.171. Cistercian church of 12 th century, of great simplicity; rectangular apse; four square eastern chapels opening into transepts, nave with slightly pointed tunnel vault, with abutting vaults of side aisles, three fourths of round tunnel vault.

Arr. of Arles. Abbey church of S. Trophime at Arles;[9] church S. Cesaire, do.; church S. Jean, do.(museum); church S. Honorat, do.; church S. Gabriel; abbey church of Montmajour; church S. Maries;[10] church S. Marthe at Tarascon.

Note 9.p.171. Beautiful cloister' portal of 12 th century, very rich in sculptures.

Note 10.p.171. Church with single nave, with semicircular apse vaulted with dome. Nave with slightly pointed tunnel vault with transverse arches. This church is fortified and dates

from the 12 th century.(See Arch. de lo Com. des mon. Hist, pub. under ouspices of minister of stote).

CALVADOS, department.

Arr. of caen. Abbey church of Trinite at Caen;[1] abbey church of S. Etienne, do.;[2] church of S. Gilles, do.;[3] church of Notre Dame, do.; church of S. Pierre, do.;[4] church of S. Jean, do.; church of S.Nicolas, do;[5] church of Bernieres; church of S. Contest; church of Fresne-Camilly; church of priory of S.Gabriel; church of Norey; church of Ouistreham; church of Secqueville-en-Bessin; church of Thaon; church of Bretteville-l'Orgueilleuse; church of Langrune; church of mathieu; church of Cully; church of Audrien; church of Mouen, church of Douvres; church of Fontaine-Henry.

Note 1.p.172. Founded by Motildo, wife of Williom the Conqueror, but olmost entirely rebuilt in the 12 th century. Apse without side oisle; onrthex; tower over middle of crossing ond two towers on the focode.

Note 2.p.172. Founded by Williom the Conqueror. Upper ports of nove rebuilt in the 12 th century; choir rebuilt in the 13 th, with side oisle ond rodioting chopels; two towers on the focode, o tower over the middle of the crossing.

Note 3.p.172. Nove of o chorming church of the end of the 1 12 th century, whose voults were rebuilt in the 15 th; orchivolts of side oisles round.

Note 4.p.172. Church olmost entirely of 16 th century, in o very florid style.

Note 5.p.172. Beoutiful plon of the end of 12 th century.

Arr. of Bayeux. Cathedral church of Bayeux;[6] church of Tour near Bayeux;[7] church of S. Loup, do.;[8] church of Asnieres; c church of Colleville; church of Etreham; church of Formigny; church of Louvieres; church of Ryes; church of Vierville; church of Campigny; church of Gueron; church of Marigny; church of Bricueville, church of S. Marie-aux-Anglais;[9] church of V Vouilly.

Note 6. p.172. Nove whose lower ports dote from the 12 th century ond upper ports from the 13 th. Choir of the middle of 13 th century, style Normon Gothic; two towers on focode, o t tower over the crossing.

Note 7. p.172. Smoll church whose opse of the 14 th century presents o porticulor orrongement (Art. Abside, Fig. 12), imi-

[illegible] from the apse of the chapel of the seminary of Bayeux [illegible]

[illegible]

Note 8.p.172. Romanesque tower of the 12 th century.

Note 9.p.172. Small church of the 12 th century, composed of a single nave with square apse; that apse alone is vaulted; it still retains traces of the paintings of the 13 th century.

Arr. of Falaise. Church S. Gervais at Falaise; church S. J[illegible] [illegible]ommes, etc.; church of [illegible] near Falaise; church of [illegible]; church of [illegible].

Arr. of Lisieux. Church S. Pierre at Lisieux; church S. [illegible] [illegible]. Church of [illegible]; church of [illegible].

Arr. of Pont-l'Évêque. Church S. Pierre at Touques.

Arr. of Vire. Church of Vire.

[illegible]

Arr. of [illegible]. Church of [illegible].

Arr. of S. Lô. Abbey church of [illegible].

Arr. of [illegible]. Church [illegible] at [illegible]; church of [illegible]; church of [illegible]; church of S. [illegible].

Arr. of [illegible]. Church of [illegible].

[illegible]

Arr. of Amiens. Cathedral; church of [illegible];[1] abbey [illegible] [illegible] S. [illegible] of [illegible];[2] church of [illegible]; church of [illegible];[3] church of [illegible]; church of [illegible]; church of [illegible];[4] church of [illegible].

Note 1[illegible].p.172. Church with [illegible], 11 th and 12 th centuries. [illegible], [illegible], vol. [illegible], [illegible].

Note 1.p.173. Church of the 12 th century with tower, with gallery beneath [illegible] of central nave. [illegible] plan. Apse with chapels in the axis of the [illegible] aisles of nave; and two [illegible] at each of their [illegible]. One of the most remarkable [illegible].

Note 2.p.173. Circular church of 12 th century.

Note 3.p.173. Church with a single nave, [illegible].

Note 4.p.173. Church with very particular [illegible] arrangement; chapel on the axis of the sanctuary; A [illegible] at right and left of that chapel, that appear to have been intended to receive reliquaries; the eastern chapels attached to [illegible] 12 th century.

Arr. of [illegible]. Church of [illegible]; church of [illegible]

imitated from the apse of the chapel of the seminary of Bayeux, which dates from the 13 th century.

Note 8.p.172. charming tower of the 12 th century.

Note 9.p.172. Small church of the 12 th century, composed of a single nave with square apse; that apse alone is vaulted, it still retains traces of the paintings of the 13 th century.

Arr. of Falaise. Church S. Gervais at Falaise; church S. Jacques, do.; church of Guibray near Falaise; church of Maizieres; church of Sassy.

Arr. of Lizieux. Church S. Pierre at Lizieux; church S. Pierre-sur-Dive; church of Vieux-pont-en-Auge; church of Breuil.

Arr. of Pont-l-Eveque. Church S. Pierre at Tonques.

Arr. of Vire. Church of Vire.

CANTAL, department.

Arr. of Aurillac. Church of Montsalvi.

Arr. of S.Flour. Abbey church of Ville-Dieu.

Arr. of Mauriac. Church Notre Dame des miracles at Mauriac; church of Ydes; church of Brageac; church of S. Martin-Valmeroux.

Arr. of Murat. Church of Bredons.

CHARENTE, department.

Arr. of Angouleme. Cathedral church of Angouleme;[10] abbey church of S. Amant of Boise;[1] abbey church of Couronne; church of S. Michel of Entraigues;[2] church of Chaumont; church of Roullet;[3] church of Plassac; church of Torsac; church of Montberan;[4] church of Mouthiers.

Note 10.p.172. Church with domes, 11 th and 12 th centuries. (Art. Cathedrale, Figs. 41, 42).

Note 1.p.173. Church of the 12 th century with domes, with gallery beneath calotte of central dome. Beautiful plan. Apse with chapels in the axes of the side aisles of nave; and two larger chapels at east of transepts. One of the most remarkable edifices of Charente.

Note 2.p.173. Circular church of 12 th century.

Note 3.p.173. Church with a single nave, domes.

Note 4.p.173. Church with very particular apsidal arrangement; chapel on the axis of the sanctuary; 4 niches at right and left of that chapel, that appear to have been intended to deposit reliquaries; two eastern chapels attached to transepts, 12 th century.

Arr. of Barbezieux. Church of Aubeterre; church of Montmoreau;

church of Riou-Martin.

Arr. of Cognac. Church of Chateauneuf; church of Gousac;[5] church of Richemont.

Note 5.p.173. Church with a single narrow nave, covered by A domes, 12 th century; choir of the 13 th century.

Arr. of Consolens. Church of S. Barteelemy at Consolens; church of Lesterps.

CHARENTE-INFERIEURE, department.

Arr. of Rochelle. Church of Esnandes.

Arr. of Marennes. Church of Marennes; church of Echillias; church of Moëse; church of S. Denis of Oleron.

Arr. of Rochefort. Church of Surgeres.[6]

Note 6.p.173. Beautiful facade of 12 th century, whose lower portion alone remains. Style of Saintonge.

Arr. of Saintes. Church of S. Eutrope at Saintes;[7] church of S. Pierre, do.; church S. Marie-des-Dames, do.;[8] church of S. Gemmes; church of Retaud; church of Thezac.

Note 7.p.173. Vast crypt of 11 th and 12 th centuries.(Art. Crypte, Figs. 10, 11). One of the purest examples of the architecture of the 12 th century in Saintonge. (Art. Chapelle, Fig. 33). Tower of the 15 th century.

Note 8.p.173. Very remarkable tower over the crossing.(Art. Clocher, Fig. 14). monument of 11 th and 12 th centuries of which remain beautiful parts, notably on the facade; sculpture of Saintonge in a beautiful style.

Arr. of S. Jean d'Angely. Church of S. Pierre at Aulnay; c church of Fenioux.

CHER, department.

Arr. of Bourges. Cathedral church of Bourges;[9] church S. Bonnet at Bourges; church of Aix-d'Angillon; church of Mehun-sur-Yevre; church of Plainpied.

Note 9.p.173. Church of 13 th century with crypt and without transepts; double stairs; beautiful collection of stained glass of 13 th and 14 th centuries.(Art. Cathedrale, Fig. 6).

Arr. of S. Amand. Church of Celle-Bruere; church of Charly: church of Conde; abbey church of Noirlac; church of Dun-le-Roy; church of S. Pierre des Etieux; church of Ineuil; church of C Chateaumeillant.

Arr. of Sancerre. Church of Aubigny; church of Jars; church of S. Satur.

CORREZE, department.

Arr. of Tulle. Cathedral church of Tulle;[1] church of Uzerche.[2]

Note 1.p.174. Nave of 12 th century; tower on porch, of 13 th and 14 th centuries, apse exists no longer. Edifice in a bastard style that belongs to the Auvergne style and that of Lyonnais.

Note 2.p.174. Pretty monument of 12 th century and very simple. Mixed style.

Arr. of Brives. Church of S. Martin at Brives-la-Gaillarde;[3] church of Arnac-Pompadour; church of Aubazine;[4] church of Beaulieu;[5] church of S. Cyr-la-Roche; church of S. Robert.

Note 3.p.174. Very curious church; apse in Auvergne style; nave of 13 th century, with side aisles whose vaults are as high as those of the nave; cylindrical piers.

Note 4.p.174. Transept with 6 square eastern chapels; dome, and tower over middle of crossing; pointed tunnel vault, 12 th century. Beautiful tomb of S. Etienne, bishop, 13 th cent.

Note 5.p.174. Beautiful church of the 12 th century.

Arr. of Ussel. Church of Ussel; church of S. Angel;[6] church of Meymac.

Note 6.p.174. Small church with apse with low niches, as if to place tombs or reliquaries, 12 th century. Simple style.

COTE D'OR, department.

Arr. of Dijon. Abbey church of S. Benigne of Dijon (cathedral);[7] church Notre Dame of Dijon;[8] church S. Michel, do.;[9] church S. Etienne, do.; church S. Philibert,do.; church S. Jean, do.; church of the Chartreuse, do.; church of S. Seine,; church of Rouvres; church of Plombierer; church of Thil-Chatel.

Note 7.p.174. Remains of a crypt of 11 th century.(Art. Crypte, Fig. 5). Church rebuilt at end of 13 th century in place of the church of 11 th century. Apse without side aisle; two chapels in the transepts, nave of great simplicity; capitals without sculpture, two towers on facade in poor style; wooden spire of 17 th century on the middle of crossing.

Note 8.p.174. Most complete type of the Burgundian architecture of the 13 th century (about 1230). Vast porch, apse without side aisle; tower on middle od crossing,whose arrangement is one of the most remarkable, although one cannot judge of it today because of additions. (Art. Construction, Figs. 75 to 82).

Note 9.p.174. Facade of 16 th century, style of Burgundian Renaissance.

Arr. of Beaune. Church of Beaune;[10] churhc of Meursalt; church of S. Sabine.[11]

Note 10.p.174. Church of 12 th century, style of Burgundy; one of the derivotives from the cotherol of Autun. Pilosters fluted; pointed tunnel voult with tronsverse orches, choir with side oisles ond three circulor chopels; porch of 13 th century, not finished; tower over middle of crossing.

Note 11.p.174. Tower on focode with porch below. Of 12 th century, rebuilt in the 13 th, now in ruins.

Arr. of Chatillon-sur-Seine. Churcr of S. Vorle at Chatillon-sur-Seine; church of Aignay-le-Duc.

Arr. of Semur. Church of Notre Dame of Semur;[12] church of Flavigny;[13] abbey church of Fontenoy near Montbard;[1] church of S. Andocne of Saulieu;[2] church of S. Thibault.[3]

Note 12.p.174. Pure Burgundion style of 13 th century; side oisles ond three chopels oround choir; vost porch; mony points of resemblonce to the church of Notre Dome of Dijon; very elegont triforium in the choir. Beoutiful sculpture.

Note 13.p.174. Smoll church of 13 th century with o rood s screen ond chopels of the 16 th century.

Note 1.p.175. Pure Cistercion church.

Note 2.p.175. Burgundion style contemporoneous with cothedrol of Autun ond church of Beoune. Nove olone exists, 12 th century. Two towers on focode; orgon gollery of wood, 15 th century. Frogments of stolls of 13 th century.

Note 3.p.175. Choir portly destroyed, built on the model of thot of church S. Urboin of Troyes. Portol of 13 th century with remorkoblo stotuory.

COTES-DU-NORD, department.

Arr. of S. Brieuc. Cathedral church of S. Brieuc; church of Lanleff; church of Notre Dame of Lamballe; church of Moncontour.

Arr. of Dinan. Church S. Sauveur of Dinan; church of priory of Lehon.

Arr. of Lannion. Church S. Pierre of Lannion; church of Treguier. (Old cathedral).

CREUSE, department.

Arr. of Gueret; church of Souterraine.[4]

Note 4.p.175. Beoutiful church of the end of 12 th century with squore opse ond 4 choples in the tronsepts; side oisles of nove very norrow; dome on the first boy with tower obove;

dome at middle of crossing; crypt (see Arch. de la Com. des m mon hist, pub. under ausp. of minister of state); church arranged to be fortified; very high side aisles with vaults abutting those of the nave. One of the most remarkable examples of this mixed style, that commences near Chateauroux, follows t the road of Limoges and extends into Correze.

Arr. of Aubusson; Church of Evaux; church of Fellein.

Arr. of Bourganeuf. Church of Benevent.

Arr. of Boussac. Church of S. Valerie at Chambon.

DORDOGNE, department.

Arr. of Perigueux. Abbey church of S. Front at Perigueux; cathedral;[5] church of la Cite,do.(old cathedral); abbey church of Brantome.[6]

Note 5.p.175. Church whose arrangement is entirely Byzontine and details are Latin, 10 th century. The type of all churches with domes in western France.(Arts. Architecture Religieusel Figs. 4, 5; Clocher, Fig. 1).

Note 6.p.175. Church in a good style without side aesles; rectagular apse; side tower; 11 th, 12 th and 13 th centuries.

Arr. of Bergerac. Church of Beaumont; church of Montpazier; abbey church of S. Avit-Seigneur.[7]

Note 7.p.175. One of the derivatives of the church of S. F Front, 12 th century.

Arr. of Nantron. Church of Cercles; church of S. Jean-de-Col; church of Bussieres-Badil.

Arr. of Sarlat. Church of Sarlat (old cathedral); church of S. Cyprien.

Arr. of Riberac. Church of S. Privat.

DOUBS, department.

Arr. of Besancon. cathedral church of Besancon;[8] church S. Vincent of Besancon.

Note 8.p.175. church with Rhenish plan of 12 th century with two apses without side aisles, one at the east and the other at the west. Edifice much mutilated. A crypt formerly under the eastern apse.

Arr. of Montbeliard. Church of Courtefontaine.

Arr. of Pontarlier. Abbey church of Montbenoit; church of priory of Morteau; abbey church of Sept-Fontaines.

DROME, department.

Arr. of Valence. cathedral church of Valence;[1] church of S.

Bernard at Romans.

Note 1.p.176. Church of 12 th century, style of Lyonnois. T Tunnel vault with transverse arches.

Arr. of Die. Church of Die (old cathedral); church of Chabrillan.

Arr. of Montelimart. Church of Grignan; church of S. Paul-Trois-Chateaux (old cathedral); churhc of S. Restitut; church of S. Marcel-des-Sauzet; church of Garde-Adhemar.

EURE, department.

Arr. of Evreux. cathedral church of Evreux;[2] church of S. T Thorin at Evreux; church of Conches;[3] church of Pacy-sur-seine; church of Vernon; church of Veronet; church of S. Luc.

Note 2.p.176. Church of 11 th, 12 th, 13 th, 14 th, 15 th, and 16 th centuries. Spire of carpentry and lead over crossing.

Note 3.p.176. magnificent stained glass of 16 th century.

Arr. of Andelys. Church of Grand Andely; church of Petit Andely; church of Gisors.

Arr. of Bernay. Abbey church of Bernay; church of Broglie; church of Fontaine-la-Soret; church of Harcourt; church of Se Serouigny; caurch of Boisney; church of Notre Dame of Louviers; church of Pont-de-l'Arche.

Arr. of Pont-Audemer. Church of Annebaut; church of Guillebeuf.

EURE-ET-LOIR, department.

Arr. of Chartres; church of Notre Dame of Chartres (cathedral);[4] church of S. Aignan, do.; abbey churnc S.Pere, do.;[5] church of S. Andre, do.; church of Gallardon.

Note 4.p.176. Crypt of 11 th century, tower and portal of 12 th, nave and choir of 13 th century. Very beautiful stained glass of 12 th and 13 th centuries.(Arts. Cathedrale, Figs. 11, 12; Clocher, Figs. 58, 59).

Note 5.p.176. Church of beginning of 13 th century, remarkable for lightness of its construction. Beautiful stained glass of the end of the 13 th century. This edifice has suffered important modifications.

Arr. of Chateaudun. Church S. Madelaine at Chateaudun; church of Bonneval.

Arr. of Dreux. Church S. Pierre at Dreux; church of Nogent-le-Roi.

FINISTERRE, department.

Arr. of Quimper. Cathedral church of Quimper; church of Loc-

Loctudy; church of Pen-Marc'h; church of Plogastel-S.Germain; church of Pontcroy.

Arr. of Brest. Church Notre Dame of Folgoët; church of Goulsen.

Arr. of Chateaulin. Church of Pleyben; church of Loc-Roman.

Arr. of Morlaix. Church of S. Jean-du-Doigt; church of Lambader; church of S. Pol-de-leon (old cathedral); church Notre Dame of Creisquer at S. Pol-de-Leon.

Arr. of Quimperle. Church of S. Croix of Quimperle.

GARD, department.

Arr. of Nimes. Abbey church of S. Gilles;[1] church of S. Martne of Tarascon.

Note 1.p.177. Portal of 12 th century, whose sculpture presents one of the most complete examples of the school of statuaries of that epoch in Provence. Nave very mutilated; crypt of 12 th century; choir (destroyed) of end of 12 th century, whose ruins offer great interest in regard to perfection of execution.

Arr. of Uzes. Church of Villeneuve-les-Avignon.

GARONNE (HAUTE), department.

Arr. of Toulouse. Cathedral church of Toulouse;[2] monastery church of Jacobins at Toulouse;[3] church of Tour,do.; abbey church of S. Sernin, do.;[4] monastery church of Cordeliers,do.

Note 2.p.177. Nave vast, without side aisles, of 12 th century; choir of 15 th century.

Note 3.p.177. Church with two naves, of end of 13 th century. (Arts. Architecture Monastique, Fig. 24 bis; Clocher, Figs. 76, 77, 78).

Note 4.p.177. The largest edifice in the south of France, 12 th century; choir with side aisles and radiating chapels; transepts with circular eastern chapels; nave with double side aisles returned along transepts. Tower of 13 th century on middle of crossing. Facade unfinished. Nave rebuilt in 15 th century, following the primitive scheme. Tunnel vaults abutted by half tunnel vaults of galleries of second story. Construction of stone and brick. Beautiful sculpture; important fragments of an older edifice. Crypt rebuilt in 14 th century and mutilated recently. Developed style of Auvergne.

Arr. of Muret. Church of Venerque.

Arr. of S. Gaudens. Church of S. Gaudens;[5] church of S. Aventin; church of S. Bertrand-de-Comminges (old cathedral); c

church of S. José of Talcahuano; [illegible] church of [illegible].[1]

[illegible]

[illegible]ings.

[illegible] to date [illegible] to 10 th century. Construction almost entirely renewed in 12 th century. Altar with exhibition of a reliquary [illegible].

Note 7.p.177. Ruin. Beautiful structure of 12 th century.

[illegible]

Arr. of [illegible]. Cathedral church of [illegible].

Note 8.p.177. Church of 15 th and 16 th centuries. Magnificent stalls and stained glass of 16 th century. Facade of 17 th century.

Arr. of [illegible]. Church of [illegible] (old cathedral).

Arr. of [illegible]. Church of [illegible].

Arr. of [illegible]. Church of [illegible]; church of [illegible].[9]

Note 9.p.177. Small church of 14 th century without aisle or [illegible], with [illegible] and square apse, built of brick and entirely fortified. No facade; pretty stained glass of 15 th c[illegible].

[illegible], Department.

Arr. of [illegible]. Church of S. [illegible] (cathedral) of [illegible]; church of S. [illegible];[10] church of S. [illegible];[11] church [illegible]; church of [illegible]; church of [illegible]; church of [illegible]; church of [illegible];[1] church of [illegible]; church of [illegible].

Note 1.p.178. Very pretty little church of 12 th century; apse complete. [illegible] an excellent [illegible]; tower [illegible]

[illegible]

Note 10.p.178. [illegible] of a beautiful facade of 12 th century.

Note 11.p.178. Church of 13 th century, much mutilated. [illegible] portal of 11 th century, under the tower. Lateral [illegible] of 13 th century, filled with good statues. Small.

Arr. of [illegible]. Church of [illegible] (old cathedral); church of [illegible]; church of [illegible]; church of [illegible].

Arr. of [illegible]. Church [illegible]; church of [illegible]; church of S. [illegible]; church of S. [illegible];[9] church S. M[illegible].

Note 9.p.178. Church of 10 th century with apse and circular ornaments, without side aisles. Facade of 12 th century. [illegible]

[illegible]

church of S. Just of Valcabrere;[6] abbey church of Montsaumes.[7]

Note 5.p.177. medium church of 12 th century, of a beautiful style.

Note 6.p.177. Small and very old church; some parts appear to date back to 10 th century. Construction almost entirely renewed in 12 th century. Altar with exhibition of a reliquary elevated above the sanctuary.

Note 7.p.177. Ruin. Beautiful structure of 12 th century.

GERS, department.

Arr. of Auch. Cathedral church of Auch.[8]

Note 8.p.177. Church of 15 th and 16 th centuries. Magnificent stalls and stained glass of 16 th century. Facade of 17 th century.

Arr. of Condom. Church of Condom (old cathedral).

Arr. of Lectoure. Church of Fleurance.

Arr. of Lombez. Church of Lombez; church of Simorre.[9]

Note 9.p.177. Small church of 14 th century without side a aisles, with transepts and square apse, built of brick and entirely fortified. No facade; pretty stained glass of 15 th c century.

GIRONDE, department.

Arr. of Bordeaux. Church of S. Andre (cathedral of Bordeaux); church of S. Croix at Bordeaux;[10] church of S. Seurin,do.;[11] church S. Michel, do.; church of Avensan; church of Pouillac; church of Leognan; church of Loupiac of Cadillac;[1] church of Moulis; church of la Sauve.

Note 1.p.178. Very pretty little church of 12 th century; v very complete. Facade on an excellent style; tower rebuilt r recently and skilfully.

Note 10.p.177. Remains of a beautiful facade of 12 th century.

Note 11.p.177. Church of 13 th century, much mutilated. Principal porch of 11 th century, under the tower. Lateral porch of 13 th century, filled with good statues. Crypt.

Arr. of Bazas. Church of Bazas (old cathedral); church of Aillas; churnc of Pondaurat; church of Uzeste.

Arr. of La Reole. Church S. Pierre of Reole; church of Blazimon; church of S. Ferme; church of S. Macaire;[2] church S.Michel.

Note 2.p.178. Church of 12 th century with apse and circular transepts, without side aisles. Facade of 13 th century. I Internal paintings of end of 13 th century, unfortunately sp-

spoiled by an unlucky restoration.

Arr. of Lesparre. Church of Begadan; church of Gaillan; church of Vertheuil; church of S. Viviere.

Arr. of Libourne. Church of S. Denis of Pilles; church of S. Emilion; church of S. Pierre of Petit Palais; church of P Pujols.

HERAULT, department.

Arr. of Montpellier. Church of Castries; church of S. Croix at Celleneuve; abbey church of S. Guilhem-le-Desert;[3] abbey church of Maguelonne; abbey church of Vignogoul at Pignan; ab-abbey church of Vallemagne; church of Villeneuve-les-Maguelonne.

Note 3.p.178. Pretty church of 12 th century, of a free character belonging to that part of the southern provinces.

Arr. of Bezieres. Church of S. Nazaire of Bezieres (old cathedral);[4] church of Agde (old cathedral); church of Espondeilhan.

Note 4.p.178. Church built in 12 th century and then fortified, rebuilt in great part at the end of the 13 th and fortified anew. Apse without side aisle, surmounted by machicolations with decorated battlements.

Arr. of Lodeve. Church S. Fulcran of Lodeve; church S. Paul of Clermont; church of S. Pons.

ILE-ET-VILAINE, department.

Arr. of Montfort-sur-Mer. Church of Montauban.

Arr. of Redon. Church of S. Sauveur-de-Redon.

Arr. of S. Malo. Church of Dol (old cathedral).[5]

Note 5.p.178. Beautiful church of 13 th century, with square apse in which opens a great glass window as at the back of En-English apses of that epoch.

Arr. of Vitre. Church of Vitre.

INDRE, department.

Arr. of Chateauroux. Church of Chatillon-sur-Indre; abbey church of Deols near Chateauroux;[6] church of Leroux; church of Meobecq; church of S. Genou;[7] church of S. Martin of Ardental.

Note 6.p.178. Ruined church of 12 th century, but whose fragments are of great purity of style. The tower alone exists e entire; it terminates in a stone cone.

Note 7.p.178. Very curious church of 12 th century, which retains in the interior the appearance of an antique basilica.

Arr. of Blanc. Abbey church of Fontgombaud;[1] church of Meo-

Mezieres-en-Brenne.

Note 1.p.179. Large and beautiful church of the 12 th century with side aisles around choir; tower over crossing; tunnel and cross vaults; external galleries around the apse. Nave has been destroyed, choir and transepts alone are standing, and a are now occupied by Trappists.

Arr. of la Chatre. Church of la Chatre,[2] church of Gargilesse; church of Neuvy-S. Sepulchre;[3] church of Nohant-Vic.

Note 2.p.179. Porch with tower above.

Note 3.p.179. Circular church of 11 th century, built in i imitation of the Holy Sepulchre. Nave attached, very old, but rebuilt in 12 th century. (See Arch. de la comm. des mon.hist., published under auspices of minister of state.

INDRE-ET-LOIRE, department.

Arr. of Tours. Cathedral church of Tours;[4] abbey church of S. Martin of Tours;[5] abbey church of S. Julien,do.;[6] church of S. Denis at Amboise; church of Vernon.

Note 4.p.179. Choir of 13 th century, in a beautiful style. Stained glass of the same epoch and intact. Facade of 16 th century.

Note 5.p.179. There remains only the principal tower of this celebradte church.

Note 6.p.179. Church of 13 th century with square apse. Tower over porch of the facade of 11 th century. Paintings.

Arr. of Chinon. Abbey church of S. Mesme at Chinon; church of Azay-le-Rideau; church of Condes; church of Langeais, church of Riviere.

Arr. of Loches. Church of S. Ours of Loches;[7] church of Beaulieu, church of Montresor; church of Preuilly.

Note 7.p.179. Church derived from churches with domes, 11 th and 12 th centuries, without side aisles. Here the domes are replaced by hollow pyramids. (Arts. coupole, Fig. 15; Clocher, Fig. 27). One tower over the apse, the other over the porch.

ISERE, department.

Arr. of Grenoble. Cathedral church of Grenoble.

Arr. of S. Marcellin. Church of S. Antoine near S. Marcellin; church of Marnans.

Arr. of Tour-du-Pin. Church of S. Chef.[8]

Note 8.p.179. Church composed of a wide nave with side aisles,

narrow transepts with circular apse and four little apses token in the theckness of the transept walls, 12 th century. Go carpentry over nave. Apse and transepts are alone vaulted. P Paintings of end of 12 th century in one of the two galleries, that terminate the transepts. The four bays of these transepts are vaulted by means of tunnel vaults perpendicular to the w walls and resting on transverse arches constructed at the height of the archivolts connecting the piers of the nave. Towers on rectangular plans at ends of transepts above the galleries. South tower alone exists.

Arr. of Vienne. Church S. Andre-le-Bas at Vienne; church S. Maurice, do.; church S. Pierre, do..

JURA, department.

Arr. of Lons-le-Saunier. Church of Baume-les-Messieurs.

Arr. of Dole. Church of Chissey.

Arr. of Poligny. Churh of S. Anatole of Salins.

LANDES, department.

Arr. of Dax. Church of Sordes, church of S. Paul-les-Dax.

Arr. od S. Sever. Church of S.Geron at Hagetman, church of S. Quitterie at Mas-d'Aire.[1]

Note 1.p.180. Near the sanctuary is that church is noted a little cell reserved in the solid wall, in which insane persons were shut.

LOIRE-ET-CHER, department.

Arr. of Blois. Church of S. Laumer at Blois;[2] church of S. Aignan; church of Mesland; church of Nanteuil at Montrachard; church of Cours-sur-Loire, church of S. Lubin at Suevnes.

Note 2.p.180. Beautiful church of 12 th century.

Arr. of Romorantin. Church of Romorantin; church of Lassay; church of S. Thaurin at Selles S. Denis; church of S. Genoux, do.; church of Selles-sur-Cher.

Arr. of Vendome. Abbey church of Trinite at Vendome;[3] church of Troo; church of Lavardin; church of S. Gilles of Montoire.

Note 3.p.180. The tower of this abbey church still exists. (art. Clocher, Figs 53 to 56). It is one of the most beautiful structures of the 12 th century, which is only surpassed by the old tower of the cathedral of Chartres.

LOIRE, department.

Arr. of Roanne. Church of Ambierle; abbey church of Charlieu;[4] church of Benisson-Dieu.

Note 4.p.180. Remains of a very beautiful style, 12 th century.

LOIRE (HAUTE), department.

Arr. of Puy. cathedral church of Puy;[5] church of S. Jean of Puy;[6] baptistery at Puy; church S. Laurent, do.; church S. Michel-de-Aiguilhe,do.; church of Chamalieres; church of Monestier; church of Polignac;[7] church of S. Paulien; church of Sanques.

Note 5.p.180. Monument whose arrangement is unique. By passing under a very high porch like a great loggia, one penetrates beneath the pavement of the church, and he ends before a high altar by a stairway. This stairs extended far into the street opposite the portal. Such a strange arrangement was m made to allow the numerous pilgrims, who visited Notre Dame of Puy, to pass in procession to the venerated image. The cathedral of Puy presents traces of a very old edifice. Constructions and elevation date from the 11 th century, they were c crowned by domes in the 12 th. A lantern rises over the middle of the crossing. The apse was square, and the ends of the transepts are terminated at north and south by little low apses. The external surfaces are composed of white stone (sandstone) and black lava, so as to form great mosaics. There were formerly in the interior numerous paintings of the 12 th century in a grand style, that have been partly destroyed. T The cathedral of Puy has retained its dependances, a great h hall of the 12 th century, a cloister of the 10 th and 11 th, a chapter hall and a master's house with paintings of the 14th.

Note 6.p.180. Edifice,some parts of which date from the 10

Note 7.p.180. Very pretty church of the 11 th century with three little apses.

Arr. of Brioude. Church S. Julien of Brioude;[8] abbey church of Chaise-Dieu; church of Chanteuges.

Note 8.p.180. Beautiful church of 12 th century and beginning of 13 th; the choir is of the last epoch, but the masses of the architecture and the system of construction have remained Romanesque. The new style makes itself felt only in the details of the sculpture and the mouldings. Numerous traces of paintings.

Arr. of Yssingeaux. Church of Bauzac; church of S. Didier-la-Sauve; church of Ristord.

LOIRE-INFERIEURE, department.

Arr. of Nantes. Cathedral church of Nantes; church of S. J Jacques at Nantes.

Arr. of Savenay. Church of S. Gildas-des-Bois; church S. G Constan; church of Guerande.

LOIRET, department.

Arr. of Orleans. Cathedral church of Orleans; church of S. Aignan at Orleans; church of Beaugency; church S. Etienne of Beaugency;[1] church Notre Dame of Clery; church of Germigny-les-Pres;[2] church of Meung; church of chapel S. Mesmin.

Note 1.p.181. Very old church, 9 th or 10 th century. Nave narrow, long and without side aisles. Very pronounced transepts with semicircular eastern chapels; choir almost equal to the nave, apse with half dome. Tunnel vaults, cross vault over middle of crossing, with large tower above. Entire absence of ornamentation. Plastering.

Note 2.p.181. Little church of 9 th century with circular apse and two little apses. Central tower borne on four isolated piers, with passage around them, as in certain Greek churches and in Angoumois. Transverse aisle passing beneath thowr, terminated by two circular apses; cross and tunnel vaults. Mosaics with gold ground covering the half dome of the principal apse. Tower with little columns and bands decorated by stucco. (This monument has been published by M. Constant-Dufeux in t the Revue d'Architecture of M. Daly, Vol. 8).

Arr. of Gien. Abbey church of S. Benoit-sur-Loire;[3] church of S. Brisson.

Note 3.p.181. Church of 12 th century with crypt and elevated choir. Vast narthex of 11 th century, with second story in intended to support a tower. (Art. Clocher, Figs. 41, 42). The sanctuary is paved with opus alexandrinum, like many Italian churches.

Arr. of Montargis. Church of Ferrieres; church of Lorris.

Arr. of Pithiviers. Church of Puissaux; church of Yevres-le-chatel.

LOT, department.

Arr. of Cahors. Cathedral church of Cahors;[4] church of Montat.

Note 4.p.181. Church derived from abbey church of S. Front at Perigueux. Domes. This edifice has suffered numerous mutilations since the 14 th century.

Arr. of Figeac. Abbey church of S. Sauveur at Figeac; church of Assier.

Arr. of Gourdon. Church of Gourdon; abbey church of Souillac.[5]

Note 5.p.181. Abbey church derived from that of S. Front. D Domes. circular apse; remains of a porch. Very curious reliefs in the interior of the entrance portal.

LOT-ET-GARONNE, department.

Arr. of Agen. Cathedral church of Agen;[6] old church of Jacobins at Agen;[7] church of Layrac; church of Moiran.

Note 6.p.181. church with domes, in great part rebuilt in 13 th century and vaulted at that time. Apse recalling on the exterior the apses of Avignon.

Note 7.p.181. Internal paintings of 13 th century. Church with two naves.

Arr. of Marmande. Church of Marmande; church of mas d'Agenais.

Arr. of Nerac. Church of Mezin.

LOZERE, department.

Arr. of Mende. Cathedral church of Mende; church of Langogne.

MAINE-ET-LOIRE, department.

Arr. of Angers. Cathedral church of Angers;[1] abbey church of S. Serge at Angers; church S. Martin, do.; abbey church of T Trinite, do.; church of Ronceray,do.; church of Lion d'Angers; church of Savennieres; church of Beaulieu.

Note 1.p.182. Vast church with nave, transepts, choir and a apse without chapels or side aisles. Built about the end of 12 th century, but presenting traces of earlier structures. Cross vaults on square plans, recalling the dome by their very swelled form. Stained glass. Style of Plantagenets. (See Arch. Byz. en France, by M. felix de Verneilh). (Art. Cathedrale, Fig. 43).

Note 2.p.182. Church with domes, but with choir surrounded by chapels with side aisles. (Art. Architecture Religieuse, Figs. 6, 7).

Arr. of Bauge. Church of Pontigne.

Arr. of Beaupreau. Church of Chemille.

Arr. of Saumur. Church of Nantilly at Saumur; church S. Pierre, do.; church of Cunault; abbey church of Fontevrault;[2] church of S. Georges-Chatelaison; church of Montreuil-Bellay; church of Puy-Notre-Dame; church of S. Eusebe of Gennes; church of S. Veterin, do.

MANCHE, department.

Arr. of S. Lo. church of S. Croix of S. Lo; church of Notre

Dues, do.; church of Carentan; church of Martigny.

Arr. of Avranches. Abbey church of Mont S.-Michel en Mer.[3]

Note 3.p.122. Church whose nave dates back to 11 th century; choir from 15 th.(Architecture Romantique, Figs 19 to 22).

Arr. of Cherbourg. Church of Querqueville.

Arr. of Coutances. Cathedral church of Coutances;[4] church of S. Pierre at Coutances;[5] church of Lessay; church of Perriers.

Note 4.p.181. Pure Norman church of first half of 13 th century; chapels added to the nave in 14 th.(Arch. Gothique, F Figs.[illegible]).

Note 5. pretty towers of 16 th century.

Arr. of Mortain. Abbey church of Mortain.

[illegible] Colomby; abbey church S. Sauveur-le-Vicomte; church S. Michel at Lestre.

Arr. of Chalons. Cathedral church of Chalons;[6] church Notre Dame of Chalons;[1] church S. Jean, do.;[2] church S. Alpin, do.; church Notre Dame de l'Epine;[3] church of Vertus; church of Courtisols.[4]

[illegible] Choir originally without side aisles, flanked by two towers on rectangular plans. One of these towers dates from beginning of 12 th century. Choir, transepts and nave rebuilt in 13 th century. In 14 th century, chapels with side aisles were added around the sanctuary. Nave rebuilt in second part of 15 th century. After a fire, the edifice was restored in 17 th century in a barbarous fashion. Beautiful fragments of stained glass. [illegible]

Note 1.p.173. Champagne church built in 12 th century, rebuilt soon after at the end of that century. Nave originally arranged to be covered by carpentry. Choir without side aisles at the origin; side aisles added about 1170. Four towers, two of which are still covered by spires of lead; one of these was rebuilt recently. (Arch. construction, Figs. 31, 44, 45).

Note 2.p.173. Nave of 11 th century covered by carpentry. Side aisles rebuilt. Choir and transepts rebuilt in 13 th century, restored in 15 th, 16 th and 17 th.

Note 3.p.173. Celebrated church of 15 th century, one of the most remarkable examples of that epoch, [illegible]

Dame, do.; church of Carentan, church of Martigny.

Arr. of Avranches. Abbey church of Mont S.-Michel en Mer.[3]

Note 3.p.182. Church whose nave dates back to 11 th century; choir from 15 th.(Architecture Monastique, figs 19 to 22).

Arr. of Cherbourg. Church of Guerqueville.

Arr. of Coutances. Cathedral church of Coutances;[4] church of S. Pierre at Coutances;[5] church of Lessay; church of Periers.

Note 4.p.182. Pure Norman church of first half of 13 th century; chapels added to the nave in 14 th.(Art. cathedrale, F Fig. 38).

Note 5. pretty towers of 16 th century.

Arr. of Mortain. Abbey church of Mortain.

Arr. of Valognes. Church S. Marie-du-Mont; church S. Mere-Eglise; abbey church S. Sauveur-le-Vicomte; church S. Michel at Lestre.

MARNE, department.

Arr. of Chalons. Cathedral church of Chalons;[6] church Notre Dame of Chalons;[1] church S. Jean, do.;[2] church S. Alpin, do.; church Notre Dame de l'Epine;[3] church of Vertus; church of C Courtisols.[4]

Note 6.p.182. Champagne church presenting very old arrangements. Choir originally without side aisles, flanked by two towers on rectangular plans. One of these towers dates from beginning of 12 th century. Choir, transepts and nave rebuilt in 13 th century. In 14 th century, chapels with side aisles were added around the sanctuary. Nave rebuilt at several points. After a fire, the edifice was restored in 17 th century in a barbarous fashion. Beautiful fragments of stained glass. (Art. Cathedrale, Fig. 33).

Note 1.p.183. Champagne church built in 12 th century, rebuilt soon after at the end of that century. Nave originally arranged to be covered by carpentry. Choir without side aisles at the origin, side aisles added about 1180. Four towers, two of which are still covered by spires of lead; one of these was rebuilt recently. (Art. construction, Figs. 41, 42, 43).

Note 2.p.183. Nave of 11 th century covered by carpentry, side aisles rebuilt. Choir and transepts rebuilt in 13 th century, restored in 14 th, 15 th and 16 th.

Note 3.p.183.Celebrated church of 15 th century, one of the most complete examples of that epoch, which modified or ended

so many old churches, and that built so few from bottom to top.

Note 4.p.123. Three churches. Naves with carpentry. 13 th century.

Arr. of Epernay. Church of Epernay; church of Montmort; church of Orbay;[5] church of Avenay; church of Dormans; church of Oger.[6]

Note 5.p.123. The choir alone of this church presents interest, and possesses apsidal chapels; it dates from the beginning of 13 th century; central chapel is larger than the others. S Style of Ile-de-France.

Note 6.p.123. Edifice of 13 th century. Square apse.

Arr. of Rheims. Church Notre Dame of Rheims (cathedral);[7] abbey church of S. Remy at Rheims;[8] church of Cauroy.

Note 7.p.123. (Art. Cathedrale, Figs 13 to 17).

Note 8.p.123. Nave of 10 th century, constructed to receive carpentry with double vaulted side aisles originally, by means of tunnel vaults perpendicular to nave; Choir of end of 12 th century. Beautiful fragments of stained glass. Transepts w with eastern chapels in two stories. Gallery of second story vaulted entirely around the edifice. Facade of 12 th century (restored). Gable of S. transept of 16 th century. Tomb of S. Remy of 1. th century, in a very mediocre style.

Arr. of S. Menehould. Church of Sommepy.

Arr. of Vitry. Church of Maisons-sur-Vitry;[9] church of Maurupt; church of Cheminon; church of S. Amand.[10]

Note 9.p.123. Nave covered by carpentry, beginning of 13 th century. Polygonad apse. Pretty little edifice.

Note 10.p.123. Edifice of 13 th century in a beautiful style. Porch low, covered by shed roof; nave with side aisles; polygonal Champagne apse without side aisles. Transepts.

MARNE (HAUTE), department.

Arr. of Chaumont. Church S. Jean-Baptiste at Chaumont; church of Vignory.[11]

Note 11.p.123. Church of 10 th century. Naves covered by carpentry, apse vaulted with side aisle and circular chapels.(Art. Architecture Religieuse, Figs. 2,3).

Arr. of Langres. Church S. Mammes of Langres (cathedral);[12] church of Issomes; church of Villars S. Marcellin.

Note 12.p.123. Edifice built from 1150 to 1200. (Art. Cathedrale. Figs 28, 29). F.cade modern.

Arr. of Vassy. Church of Blecourt; church of Gaffonds; church of Joinville; church of Moutirender;[13] church S. Aubin at Moëslains; abbey church of Trois-montaines.

Note 13.p.123. Choir and transept of beginning of 13 th century. Best example of that epoch in upper Champagne.

MAYENNE, department.

Arr. of Laval. Church of Trinite at Laval; church S. Martin do.; church of Asnieres; church of Evron.

Arr. of chateau-Gontier. Church S. Jean at Chateau-Gontier; abbey church of la Rue.

Arr. of Mayenne. Church of Javron.

MEURTHE, department.

Arr. of Nancy. Church of Laitre-sous-Amance. Church S. Nicolas-du-Port., church of Mouson.[1]

Note 1.p.124. great church of 15 th century. Beautiful plan.

Arr. od Sarrebourg. Church of Fenestrange.

Arr. of Toul. Church of Toul (old cathedral);[2] church S. G Gengoulfat Toul, church of Blened-aux-Oignons; church of Minorville.

Note 2.p.124. Choir and transepts of 13 th century, without side aisles. Facade of 15 th century, very rich.

MEUSE, department.

Arr. of Par-le-Duc. Church of Rambercourt-aux-Pots.

Arr. of Montmedy. Church of Avioth.

Arr. of Verdun. Cathedral church of Verdun;[3] church of Etain; abbey church of Lachalade.

Note 3.p.124. (Art. Architecture Religieuse, Fig. 39).

MORBIHAN, department.

Arr. of Vannes. Church S. Gildas-de-Rhuys; church of Ile d' Aiz.

Arr. of Lorient. Church of Hennebon.

Arr. of Ploermel. Church of Ploermel.

Arr. of Pontigny. Church of Quelven at Guern.

MOSELLE, department.

Arr. of Metz. Cathedral church of Metz;[4] church of S. Vincent at Metz; church of Chazelle; church of Norroy-le-Veneur; church of Jussy.

Note 4.p.124. Church whose nave dates from 13 th century and choir from the 15 th; the latter construction rebuilt entirely in accordance with the preceding. Style Gothic already impres-

impressed with German taste. Very beautiful glass of the 16 th century in the transepts, which are not lighted by Rose windows, but by immense windows comprising the entire space left between the premier gallery and the vaults. The towers, instead of being erected on the facade, are placed on the t third bays of the side aisles of the nave.

Arr. of Briey. Church of Olley; church of Languyon.

NIEVRE, department.

Arr. of Nevers. Cathedral church of Nevers;[5] church of S. Etienne at Nevers;[6] church of Saulge; church of S. Parize-le-Chatel.

Note 4.p.124. Church having an apse at the west built in the 11 th century. Vast transepts into which opens that apse; date likewise of that epoch. The nave was rebuilt in the 13 th century. Restorations and additions during the 14 th and 15 th centuries. This church threatens ruin; the nave leans over; its triforium presents an ornamentation with caryatides and figures of angels in the tympanums, which give a very original appearance to this interior. The edifice is much mutilated by the hand of man and by time.

Note 6.p.124. Auvergne church of 11 th century. (Architecture Religieuse, Fig. 8.).

Arr. of Clamecy. Church S. Martin at Clamecy;[1] church of C Corbigny; church of S. Reverien; church S. Leger at Tannay; church of Varzy.

Note 1.p.125. Church of first half of 13 th century, with square apse and side aisle extending behind the sanctuary. Fo Facade and tower of end of 15 th century.

Arr. of Cosne. Abbey church of S. Croix at la Charite;[2] Church of Danzy; church of Premery.

Note 2.p.125. Great church of order of Cluny, of which remains the choir, a tower and ruins. Very large narthex, with side aisles, 12 th century. Style of architecture of Autun, B Beaune, Paray-le-Monial and Cluny.

NORD, department.

Arr. of Lille. Church S. Maurice at Lille.

Arr. of Avesnes. Church of Solve-le-Chateau.

Arr. of Dunkerque. Church S. Eloi of Dunkerque.

OISE, department.

Arr. of Beauvais. Cathedral church of Beauvais;[3] church of

Essa-Oeuvre at [illegible]; church of S. Etienne, do.; abbey church of S. Germer; church of Wordsey; church of Treve-Cas-[illegible].

Note 3.p.185. Choir of 11 th century; transepts and part of nave of 12 th. This is the largest choir of French churches. ([illegible]).

Note 1.p.187. Nave of a church of 8 th or 9 th century, covered by carpentry; [illegible] of 11 th century. Construction without [illegible], [illegible]. [illegible] of 12 th century.

Note 4.p.188. Nave of 12 th century; choir of 13 th. [illegible] [illegible]. Portal of 12 th century on north side; very ornate, with traces of paintings.

Note 5.p.188. Great church of 12 th century, with vaulted [illegible] of second story. [illegible] of 13 th century, [illegible] of the nave, [illegible] in S. [illegible] of the palace [illegible].

Note. 11 [illegible]. Church of [illegible]; church of [illegible]; [illegible] of [illegible]; church of abbey of Bury; church S. [illegible]; church of [illegible].

Note 7.p.189. For these churches, see the work on the [illegible].

Note. [illegible] [illegible]; church S. [illegible]; [illegible] church of [illegible]; church of [illegible]; church of [illegible].

Note 9.p.189. [illegible] church of [illegible] of 12 th century. Beautiful fragments of [illegible] close.

Note 9.p.189. 11 th and 12 th centuries.(Art. [illegible], Vol.5.

Note 1.p.190. Only [illegible], very early [illegible] [illegible] [illegible] the 12 th century.

Note 11.p.190. [illegible] end of 12 th century. (Art. [illegible], Fig. [illegible]).

Dep. of Senlis. Church of Senlis (old cathedral); collegiate church S. [illegible] at Senlis; church S. [illegible], do. [illegible] of [illegible]; church of [illegible] (Isle); abbey church S. [illegible]; collegiate church of [illegible]; collegiate church [illegible]; abbey church of [illegible]; church of

Basse-oeuvre at Beauvais;[4] church of S. Etienne, do.;[5] abbey church of S. Germer;[6] church of Montagny; church of Trye-Chateau.

Note 3.p.185. Choir of 13 th century! transepts and part of nave of 16 th. This is the largest choir of French churches. (Arts. cathedrale, Fig. 22; construction, Figs. 101, 101 bis, 101 ter).

Note 4.p.185. Nave of a church of 8 th or 9 thecentury, covered by carpentry; facade of 11 th century. Construction without any ornamentation, barbarous Romanesque. Traces of paintings of 12 th century.

Note 5.p.185. Nave of 12 th century, choir of 15 th. Beautiful Renaissance glass. Portal of 12 th century on north side; very ornate,with traces of paintings.

Note 6.p.185. Great church of 12 th century, with vaulted gallery of second story. Holy chapel of 13 th century, isolated at the apse, nearly copied in S. Chapelle of the palace at Paris.

Arr. of Clermont. Church of Clermont; church of Agnetz; church of Maignelay; church of priory of Bury; church S. Martin-aux-Bois; church of Magneville.[7]

Note 7.p.185. For these churches, see the work on the Beauvaisais, by Dr. Woillez.

Arr. of Compiegne. Abbey church S. Antoine at Compeigne; a abbey church S. Jean-aux-Bois;[8] church Notre Dame of Noyon;[9] (old cathedral); church of Pierrefonds;[10] church of Tracy-le-Val.[11]

Note 8.p.185. Pretty little church of beginning of 13 th c century. Beautiful fragments of grisaille glass.

Note 9.p.185. 12 th and 13 th centuries.(Art. Cathedrale,Fig.7).

Note 10.p.185. Crypt of very early epoch partly excavated in the rock. Tower terminated by a top in the 16 th century.

Note 11.p.185. Charming tower of end of 12 th century. (Art. Clocher, Fig. 49).

Arr. of Senlis. Church of Senlis (old cathedral);[12] collegiate church S. Frambourg at Senlis; church S. Vincent, do.; church of Acy-en-Multien; abbey church of Chaalis; church Notre Dame of Chambly; church of Creil (en l(isle);[1] abbey church S. Leu of Esserent;[2] collegiate church of Mello;[3] collegiate church of Montataire; abbey church of Morienval;[4] church of

[illegible]-les-[illegible]; church of [illegible]; church of [illegible], church of [illegible].

[illegible] 12th century, with vault[illegible] of [illegible] stone. This church originally had no [illegible]; its [illegible] were established in the 15th century [illegible] the [illegible] of the nave. Very [illegible] [illegible]. Beautiful tower of beginning of 12th century. [illegible] [illegible]. Fig. [illegible].

[illegible]. Ruins of a very beautiful [illegible] of 12th cent.

[illegible]. [illegible] of 11th century, with [illegible] in [illegible]. Choir of end of [illegible], with [illegible] chapels [illegible] of the [illegible]. Tower of 13th century. [illegible] [illegible] at the [illegible] of the triforium.

[illegible]. End of 12th century. Well restored.

[illegible]. Church of end of 11th century, with chapels [illegible] the [illegible] of the [illegible], that date from that [illegible]. [illegible] tower of the [illegible] of the 12th century or the [illegible] and two towers at the two [illegible] of the choir. Consid[illegible] [illegible] in the [illegible] th century.

[illegible]

[illegible]. of Alencon. Church Notre Dame at Alencon; cathedral o[illegible] [illegible].

[illegible]. [illegible] of a portal of end [illegible] century, [illegible] 13th century, Norman [illegible]. Choir of end of [illegible] century, [illegible] style, [illegible] towers [illegible]. [illegible] [illegible] [illegible] [illegible] and [illegible] [illegible]. The [illegible] date from [illegible] of the [illegible] th century.

[illegible]. Church [illegible] at [illegible]; church of [illegible].

[illegible]

[illegible]. of [illegible]-l'Abbaye.

[illegible]

Arr. of S. Omer. Church Notre Dame at S. Omer (cathedral); [illegible] church S. [illegible] at S. Omer; church of [illegible].

[illegible]

Arr. of Clermont. Cathedral church of Clermont; church [illegible]-[illegible]-du-Port at Clermont; church of S. [illegible] at [illegible]; [illegible]

[illegible]; church of [illegible]; church of S. [illegible]; [illegible]

Nogent-les-Vierges; church of Ermenonville; church of Baron; church of Verberie.

Note 12.p.185. Edifice of end of 12 th century, with vaulted gallery of second story. This church originally had no transepts; its transepts were established in the 15 th century by cutting off two bays of the nave. Very narrow radiating chapels. Beautiful tower of beginning of 12 th century. (Art-Clocher, Fig. 63).

Note 1.p.186. Ruins of a very beautiful church of 12 th cent.

Note 2.p.186. Narthex of 11 th century, with hall in second story. Choir of end of 12 th. Little radiating chapels around the side aisle of the apse. Tower of 13 th century. Extreme of chevet possesses a story at the height of the triforium.

Note 3.p.186. End of 12 th century. Much mutilated.

Note 4.p.186. church of end of 11 th century, with chapels around the side aisle of the sanctuary, that date from that epoch. A tower of the beginning of the 12 th century on the facade and two towers at the two sides of the choir. Considerable rebuildings in the 14 th century.

ORNE, department.

Arr. of Alencon. Church Notre Dame of Alencon; cathedral c church of Seez.[5]

Note 5.p.186. Remains of a portal of end of 12 th century. Nave of 13 th century, Norman style. Choir of end of 13 th century, French style. Two towers of 13 th century on the facade. This edifice threatens ruin at several points' and has suffered serious mutilations. The apsidal chapels date from the middle of the 13 th century.

Arr. of Argentan. Church S. Martin at Argentan; church of Chambois.

Arr. of Domfront. Church Notre Dame sous-l'Eau at Domfront; church of Lanlay-l'Abbaye.

PAS-DE-CALAIS, department.

Arr. of S. Omer. Church Notre Dame at S. Omer (old cathedral); abbey church S. Bertin at S. Omer; church of Acre-sur-la-Lys.

PUY-DE-DOME, department.

Arr. of Clermont. Cathedral church of Clermont;[6] church Notre-Dame-du-Port at Clermont;[7] church of S. Cerneuf at Billom; church of Chauriat; church Notre D.me of Orcival; church of Montferrand; church of Royat;[8] church of S. Saturnin. church

of Chamalieres.

Note 6.p.186. church rebuilt at end of 13 th century on an old edifice of 11 th century. (Art. Cathedrale, Fig. 42).

Note 7.p.186. Edifice of 11 th century, pure Auvergne style. Cryp. (Art. Architecture Religieuse, Figs 9, 10, 10 bis).

Note 8.p.186. Little Auvergne church of 11 th century, fortified and restored at the end of the 12 th. Crypt.

Arr. of Issoire. Church S. Paul at Issoire;[9] church of Chambon; church of Monglieu; church of S. Nectaire.[10]

Note 9.p.186. Pure Auvergne style. Great church of 11 th c century. Crypt.

Note 10.p.186. Same as the last.

Arr. of Riom. Church Notre-Dame-du-Marturet at Riom; church of S. Amable of Riom; church of Ennezet;[11] church of S. Hilaire-la-Croix; churhc of Mozat; church of Thuret; church of V Volvic;[12] church of Gondat; church of Menat.

Note 11.p.186. Nave of 11 th century; choir and transepts of 13 th. Paintings.

Note 12.p.186. Very pretty church of 13 th century, Auvergne style.

Arr. of Thiers. Church S. Genest of Thiers; church of Dorat.

PYRENEES, BASSES, department.

Arr. of Pau. Church of Lembeye; church of Lescar; church of Morlas.

Arr. of Bayonne. Cathedral church of Bayonne.[1]

Note 1.p.187. 13 th, 14 th and 15 th centuries.

Arr. of Mauleon; church S. Engrace.

Arr. of Oloron. Church S. Croix at Oleron; church S. Marie at Oloron.

PYRENEES, HAUTES, department.

Church of Luz;[2] church S. Savin; church of Ibas near Tarbes.

Note 2.p.187. Little fortified church.

PYRENEES, ORIENTALES, department.

Arr. of Perpignan. Church S. Jean at Perpignan (now cathedral); church of Elne.[3]

Note 3.p.187. 12 th century.

Arr. of Ceret. Church of Coustouges.

Arr. of Prades. Church of Marceval; abbey church S. Martin du Canigou;[4] church of Corneille; church of Serrabone;[5] church of Villefranche.

Note 4.p.187. 12 th century.

Note 5.p.187. 12 th century.

RHIN, BAS, department.

Arr. of Strasburg. Cathedral church of Strasburg.[6] church S. Pierre at Strasburg; abbey church of S. Etienne, do.; church S. Thomas, do.; church of Niederhaslach.

Note 6.p.187. Choir and transepts of 12 th century. Crypt. Nave of 13 th century; Fac.de of 14 th and 15 th centuries. Beautiful glass. Stone spire very remarkable from point of view of construction.(Art. Fleche).

Arr. od Saverne. Church S. Jean-des-Choux; abbey church of Marmoutier;[7] church of Neuweiler.[8]

Note 7.p.187. Rhenish style, 12 th century. Porch between two towers.

Note 8.p.187. Church of end of 12 th century. Isolated chapel at the apse, of 10 th century.(Art. chapelle, Figs.22,23).

Arr. of Schelestadt. Church S. George of Schelestadt; church S. Foi at Schelestadt;[9] church of andlau; abbey church of S. Odile; church of Rosheim.[10]

Note 9.p.187. Church of 11 th and 12 th centuries, Rhenish style. Tower on centre of crossing. Porch between two towers on the facade.

Note 10.p.187. Pretty church in Rhenish style, 11 th and 12 th centuries. Beautiful sculpture.

Arr. of Wissembourg. Church of Walbourg.

RHIN, HAUT, department.

Arr. of Colmar. Church S. Martin at Colmar; church of Guebserschwyr; church of Guebwiller;[11] church of Pfaffenheim; church of Ruffach; church of Sigolsheim; church of Luttenbach; a abbey church of Murbach.[12]

Note 11.p.187. Pretty church of end of 12 th century and of the 13 th. Porch between two towers on the facade. Tower on middle of crossing; Beautiful Rhenish construction.

Note 12.p.187. Remains of a beautiful church of 12 th century. Two towers at the two sides of the choir. Pure Rhenish style.

Arr. of Altkirch. Church of Ottmarsheim.[13]

Note 13.p.187. Octagonal church; imitation of Aix-la-Chapelle.

Arr of Belfort. Church of Thann.

RHONE, department.

Arr. of Lyons. Cathedral church of Lyons;[1] church S. Nizier, do.; church of Ainay,[2] do.; church S. Paul, do.; church S. Irene, do.; church of Ile-Barbe.

Note 1.p.188. Choir of end of 12 th century, without side aisles, with two deep chapels opening from transepts. Nave of 13 th and 14 th centuries. Facade of 14 th. Towers at both sides of choir. Singular mixture of Gothic styles of upper Burgundy, Bourbonnais, Up. Marne and Rhine.

Note 2.p.188. Little church of which some parts are very old and date from the 9 th century. Tower of 11 th, apse of same epoch. Edifice that has suffered much from restorations. The apse without side aisles belongs to the style of Auvergne.

Arr. of Villefranche. Church of Villefranche, church of Salles; church of Belleville; church of Chatillon-d'Azergue.

SAONE, HAUTE, department.

Arr. of Vesoul. Abbey church of Cherlieu; church of Favernay; church of Chambarnay-les-Bellevaux.

Arr. of Lure. Abbey church of Luxeuil.

SAONE-ET-LOIRE, deparment.

Abbey church S. Vincent at Macon; abbey church S. Philibert at Tournus;[3] church of Brancion; church of Chapaise; abbey church of Cluny;[4] church Notre Dame at Cluny.[5]

Note 3.p.188. Nave of beginning of 11 th century, with vast narthex. The high vaults of nave present the peculiarity, that they are composed of round tunnel vaults and are abutted by those of the side aisles, which are cross vaults. The piers are single columns, terminated by flat capitals without ornaments, like simple cords. The narthex is in two stories. Transepts and choir of beginning of 12 th century, with crypt, side aisle and rectangular chapels. Square tower over middle of crossing and two towers on the first bays of narthex, of 12 th century.(Art. Architecture Monastique, Fig. 3, and Arch des mon. hist.).

Note 4.p.188. Art. Architecture Monastique, Fig. 2. Church of which nothing now remains but one transept.

Note 5.p.188. Pretty church of beginning of 13 th century, of the better style of upper Burgundy. Lantern over centre of crossing.

Arr. of Autun. Cathedral church of Autun.[6]

Note 6.p.188. Church of 12 th century, with open porch and

little later than the original construction. Style of upper B Burgundy. Nave with pointed tunnel vault with pointed transverse arches. Choir without side aisles. (Arts Architecture R Religieuse, Fig. 20, Cathedrale, Fig. 27). Stone spire of 15 th century over middle of crossing. Flying buttresses of 15 th century abutting the high vaults.

Arr. of Chalon. Church S. Vincent at Chalon; church S. Marcel; church of Sennecy-le-Grand.

Arr. of Charolles. Church of Paray-le-Monial;[7] church of Semur-en-Brionnais;[1] church of Anzy; church of Bois-S-Marie;[2] church of Chateauneuf;[3] church of S. Germain.

Note 7.p.188. Very remarkable edifice contemporaneous with cathedral of Autun (12 th century), with closed porch in two stories; sanctuary with side aisle and three radiating chapels. Central tower octagonal. Two towers on the two first bays of the porch. (See Arch. des mon. hist). Beautiful structure executed in beautiful materials.

Note 1.p.188. Edifice of end of 12 th century. Style of upper Burgundy. Flowery transitional Romanesque. Beautiful structure.

Note 2.p.188. Little church of 12 th century, whose choir presents in plan an entirely special arrangement. Side aisle without radiating chapels, the sanctuary supported by clusters of columns, two larger ones set radially, and two smaller ones set t.ngent. Tower central, nave with pointed tunnel vault on transverse arches; cross vaults over side aisles, without flying buttresses.

Note 3.p.188. Little church of 12 th century without transepts; nave with narrow side aisles and three apses. Square tower before sanctuary. High pointed tunnel vaults, abutted by r rampant cross vaults over side aisles. The central tunnel vault returned alone marks the transept in elevation.

SARTHE, department.

Arr. of Mans. Cathedral church of Mans;[4] church of Notre-Dame-du-Pre at Mans;[5] church Notre-Dame-de le Coulture at Mans.[6]

Note 4.p.188. Nave of 11 th century, repaired and vaulted in 12 th, originally covered by carpentry. Choir of 13 th century. Style mixed French-Norman. (Art. Cathedrale, Figs. 34, 35). Stained glass.

Note 5.p.188. Little church of beginning of 11 th century,

repaired in the 12 th; originally covered by visible carpentry.
Note 6.p.189. Nave without side aisles, of 12 th century. I Influence of western style, choir of end of 12 th century. P Porch of 13 th. Crypt.
Arr. of Fleche. Church of priory of Solesmes; church of Bazouges; church of la Bruyere.
Arr. of Mamers. Church of Ferte-Bernard.[7]
Note 7.p.189. Very pretty church of 16 th century, in which Gothic traditions are very skilfully retained in a new form. Stained glass.
Arr. of S. Calais. Church of S. Calais.
SEINE, department.
Arr. of Paris. Church Notre Dame (cathedral of Paris);[8] abbey church S. Germain-des-Pres, do.;[9] church S. Germain-l'Auxerrois, do.;[10] church S. Eustache, do.;[11] church S. Merry, do.; church S. Severin, do.; church of priory of S. Martin-des-Champs, do.;[12] church S. Julien-le-Pauvre, do.[1] church S. Etienne.-du-mont, do.; church Ss. Gervais and Protais, do.
Note 8.p.189. Cathedral of end of 12 th century, nave and p portal of beginning of 13 th. Transept gables of middle of 13 th century. Choir chapels of 14 th. (Art. Cathedrale, Figs. 1 to 5.
Note 9.p.189. Nave of 11 th century, entirely rebuilt. Choir of end of 12 th century, which has suffered notable alterations. One tower on the facade forming a porch, whose construction dates back to the 9 th century. Two towers at both transepts, now destroyed.
Note 10.p.189. Nave of 14 th and 15 th centuries; choir of 15 th. Romanesque tower near the south transept, now destroyed.
Note 11.p.189. Vast church of 16 th and 17 th centuries.
Note 12.p.189. Choir of 11 th century, vaulted anew in the 12 th. Nave without side aisles, of 13 th century, covered by ceiled visible carpentry. This religious edifice, after Notre Dame, is most interesting of those still existing in Paris.
Note 1.p.190. Charming little church of end of 12 th century.
Arr. of Sceaux. Church of Arcueil; church of Vitry; church of Issy; church of S. Maur; church of Nogent-sur-Marne; church of Bagneux.[2]
Note 2.p.190. Pretty church of end of 12 th century; very much injured by modern restorations.
Arr. of S. Denis. Abbey church of S. Denis;[3] church of Bou-

Boulogne;[4] abbey church of Montmartre;[5] church of Suresne; a abbey church of Longchamp; church of Charonne.

Note 3.p.190. Crypt of 11 th century. Circuit of choir, chapels of front portion of nave were built by abbot Suger at middle of 12 th century. Choir, transepts and elevated nave built under S. Louis. Old stained glass of 12 th century. Q Quantity of precious fragments.(See Abbaye de S. Denis, by M. Baron de Guilhermy).

Note 4.p.190. Choir and transepts of 13 th century.

Note 5.p.190. Little church of end of 12 th century. (See Statist. mon. de paris, by M. Albert Lenoir).

SEINE-INFERIEURE, department.

Arr. of Rouen. Cathedral church of Rouen;[6] church S. Maclou do.;[7] abbey church S. Ouen, do.;[8] church S. Patrice, do.; church S. Vincent, do.; church S. Godard, do.; church S. Gervais, do.; church of Mont-au-Malades, do.; abbey church S. Georges of Bocherville;[9] church of Duclair; church of S. Etienne at Elbeuf; church S. Jean, do.; Abbey church of Jumieger;[10] church of Molineaux; church of Yainville; church of Nouppeville.

Note 6.p.190. Circuit of choir of end of 12 th century; nave and choir of 13 th. Transept gables of 14 th. Facade of 16 th. Tower of 12 th, north side of facade; tower of 16 th at south side. This vast church has suffered numerous repairs. (Art. Cathedrale, Fig. 39).

Note 7.p.190. Church of 15 th and 16 th centuries. Pretty plan.

Note 8.p.190. This church can pass as the masterpiece of re religious architecture of the 14 th century; only completed in the 15 th.

Note 9.p.190. Norman church of 12 th century.

Note 10.p.190. Ruins from the 12 th century.

Arr. of Havre. Church of Angerville-d'Orcher; church of Etretat; church of Graville-l'Eure; church of Harfleur; church of Lillebonne; church of Montiviller.

Arr. of Dieppe. Church S. Jacques of Dieppe; abbey church of S. Victor; church of Arques; church of Auffay; church of Bourgdun; abbey church of Eu;[11] church of college of Eu; church of Treport.

Note 11.p.190. Curious churh, whose choir dates from end of 12 th century, and nave from 13 th. Choir was entirely rebuilt

in 15 th century. Crypt. French style in choir and Norman in nave. (See Arch. des mon. hist.).

Arr. of Neufchatel. Church of Eournay; church of Aumale.

Arr. of Yvetot. Church of Caudebec; church S. Gertrude; church of Valliquerville; abbey church of S. Wandrille;[12] church of S. Wandrille.

Note 12.p.190. Ruins of 12 th century.

SEINE-ET-MARNE, department.

Arr. of Melun. Church of Notre Dame of Melun;[1] church of S. Aspais at Melun; church of Brie-Comte-Robert; church of Champeaux.[2]

Note 1.p.191. Little church with choir without side aisle, with lateral towers. The substructures of these towers and t transepts date from the 10 th century, the nave dates from the 12 th century, and was formerly covered by visible carpentry; choir is of the 13 th century.

Note 2.p.191. Pretty church of beginning of 13 th century. Nave with round windows taking the place of the triforium as above the gallery of Notre Dame of Paris, before the changes made in the 13 th century.

Arr. of Coulommiers. Church of S. Cyr; church of Villeneuve-le-Comte.

Arr. of Fontainebleau. Church of Chateau-Landon; church of Larchant; church of Moret;[3] church of Nemours.

Note 3.p.191. Church with choir dating from end of 12 th c century, without side aisles; circular openings serving for triforium. Transept windows with tracery occupying entire surface of gable wall.

Arr. of Meaux. Cathedral church of Meaux;[4] church of Chauvigny; church of Chapelle-sous-Crecy;[5] church of Ferrieres;[6] church of Othiss.

Note 4.p.191. Edifice contemporaneous with Notre Dame of Paris, but almost entirely rebuilt about the middle of 13 th century, then successively repaired during the 15 th and 16 th centuries.

Note 5.p. 191. Very pretty church of beginning of 13 th century.

Note 6.p.191. Church without transepts; nave lighted by rose windows. Good arrangement of chapels at end of side aisles. Facade now destroyed, 13 th century.

Arr. of Provins. Church S. Quiriace at Profins;[7] church of S. Croix, doa; Church S. Ayoul, do.; church of Dommenarie; ch church S. Loup of Naud;[8] church of Rampillon;[9] church of Voultan.

Note 7.p.191. Church in good style, from end of 1u th cent.

Note 8.p.191. church of end of 11 th century. Porch of 12 th, with remarkable stairway.

Note 9.p.191. 13 th century. Sculptured portal.

SEINE-ET-OISE, department.

Arr. of Versailles. Church of Poissy;[10] church of Triel; ch church of Bougival; church of Vernouillet;[11] church of Thiverval.

Note 10.p.191. Porch and facade of 9 th century; some piers in interior from end of 11 th, nave of 12 th, repaired in 16 th and 17 th centuries, choir of end of 12 th; apsidal chapel of 13 th; chapels of nave and lateral porch from 1. th. Central tower of 12 th; tower on facade from 12 th, partly rebuilt in 16 th. No transepts. Side aisle enclosing the choir with two lateral eastern chapels from end of 12 th century.

Note 11.p.191. Very pretty church of end of 12 th century, with central tower of 13 th. Square apse. Facade destroyed.

Arr. of Etampes. Church Notre Dame at Etampes;[12] church S. Martin, do.; church S. Basil, do.; abbey church of Marigny; church of Ferte-Aleps.[13]

Note 12.p.191. 12 th and 13 th centuries. Tower with stone spire.

Note 13.p.191. Edifice of 12 th century; tower of same epoch, terminated by a stone spire.

Arr. of Corbeil. Church S. Spire of Corbeil; church of Athis-Mons, abbey church of Longpoint.

Arr. of Mantes. Church Notre Dame of Mantes;[14] church of H Houdan; church of Vetheuil;[1] church of Gassicourt;[2] church of Limay; church of Fusiers, church of Richebourg.

Note 14.p.191. Church presents a reduced copy of Notre Dame of Paris, built at a single spurt at end of 12 th century, c choir chapels of 14 th century; towers on the facade from 13 th. Stained glass.

Note 1.p.192. Simple apse without side aisles from 12 th c century; nave of 16 th; pretty Renaissance porch.

Note 2.p.192. Little church with square apse from 13 th century, foc.da if 11 th; nave of 15 th.

Arr. of Pontoise. Churcr S. Maclou of Pontoise; church of

Deuil; church of Ecouen; church of Taverny; church of Luzarches; church of Mereil-en-France; church S. Martin at Montmorency; church of Belloy;[3] church of Champagne;[4] abbey church of Royaumont; church of Beaumont-sur-Oise; church of Nesles;[5] c church of Gonesse; abbey church of Maubuisson.

Note 3.p.192. Church very much mutilated; pretty facade of 16 th century, well preserved.

Note 4.p.192. Little church of 13 th century, in an excellent style.

Note 5.p.192. Little church of beginning of 13 th century; lateral tower of 12 th.

Arr. of Rambouillet. Church of Montfort-l'Amaury;[6] church S. Sulpice of Favieres.[7]

Note 6.p.192. Beautiful Renaissance stained glass.

Note 7.p.192. Charming structure of middle of 13 th century; very large openings. Beautiful stained glass.

SEVRES, DEUX, department.

Arr. of Niort. Church Notre Dame of Niort; church of Champdeniers; church of S. Maixent;.

Arr. of Bressuire. Church of Bressuire; church of Oyron; c church S. Denis at Thouars.

Arr. of Melle. Church S. Pierre at Melle;[8] church S. Hilaire, do.;[9] church S. Savinien, doa; church of Celles; church of Javarzay.

Note 8.p.192. Pretty church of 12 th century.

Note 9.p.192. Of 12 th century. Beautiful style of Poitou.

Arr. of Parthenay. Church S. Laurent at Parthenay; church S. Croix, do.; church Notre Dame de-la-Couldre, do.; church S. Pierre at Airvault; church of S. Generoux; church of Marnes; church of S. Louis of Marnes, church of Parthenay-le-Vieux;[10] church of Verrines-sous-Celles.

Note 10.p.192. All these churches belong to the best style of Poitou, 12 th century.

SOMME, department.

Arr. of Amiens. Church Notre Dame (cathedral of Amiens);[11] church Notre Dame of Araines; church of Namps-au-Val; church of S. Denis-de-Poix.

Note 11.p.192. Edifice entirely rebuilt during 13 th century. (Art. Cathedrale, Figs 19, 20).

Arr. of Abbeville. Collegiate church of S. Wulfram of Abbe-

Abbeville;[12] Abbey church of S. Riquier;[13] church of Rue.

Note 12.p.192. Edifice built at beginning of 16 th century. The single nave has been raised.

Note 13.p.192. 16 th century.

Arr. of Doullens. Church of Beauval.

Arr. of Montdidier. Church of Ailly-sur-Noye; abbey church of Bertheaucourt; church of Folleville; church of S. Pierre of Roye; church of Tilloloy.

TARN, department.

Arr. of Alby. Church S. Cecile (cathedral of Alby).[1]

Note 1.p.193. Church with single nave without transepts, with chapels, built of brick; 14 th and 15 th centuries. (Art. Cathedrale, Fig. 50). Paintings of the epoch of the Renaissance.

Arr. of Castres. Church of Burlatz.

TARN-ET-GARONNE, department.

Arr. of Montauban. Church of Caussade;[2] church of Montpezat;[3] church of Varen.[4]

Note 2.p.193. Tower of 14 th century.

Note 3.p.193. Church with single nave and without transepts; 14 th century.

Note 4.p.193. Church of 12 th century with two twin apses.

Arr. of Castel-Sarrazin; church of Beaumont-de-Lomagne; abbey church of Moissac.[5]

Note 5.p.193. Narthex of 11 th century, in three stories; porch of 12 th; nave of 14 th, without side aisles and without transepts.

VAR, department.

Arr. of Draguignan. Cathedral church of Frejus; abbey church of Thoronet;[6] church of Caunet; church of Luc.

Note 6. Cistercian church of 12 th century, of great simplicity. (See arc. des mon. hist).

Arr. of Brignoles. Church S. Maximin.

Arr. of Grasse. Church of Vence. (Old cathedral).

Arr. of Toulon. Church S. Louis at Hyeres; church of Sollies-Ville; church of Sixfours.

VAUCLUSE, department.

Arr. of Avignon. Church Notre Dame-des-Doms (cathedral of Avignon);[7] church of Cavaillon (old cathedral);[8] church of Thor;[9] church of Vaucluse; abbey church of Senanque.

Note 7.p.193. Edifice of 12 th century, but unrecognizable

Note 7.p.193. Edifice of 12 th century, but unrecognizable because of the mutilations it has suffered.

Note 8.p.193. Church of 13 th century, which has retained all the characteristics of the Romanesque architecture of Provence.

Note 9.p.193. Very delicate architecture in which one feels the immediate enfluence of Roman arts.

Arr. of Apt. Church of Apt (old cathedral).

Arr. of Carpentras. Church S. Siffrin at Carpentras; church of Purnes; baptistery of Venasque;[10] church of Caromb.

Note 10.p.193. Edifice of 8 th or 9 th century, vaulted; r resembling a very small hall of the antique baths, but of very coarse construction.

Arr. of Orange. Church of Vaison (old cathedral); church of Valreas.

VENDEE, department.

Arr. of Fontenay. Church of Fontenay-le-Comte; church of Maillerais; abbey church of Nieuil-sur-Authise; church of Vouvant.

VIENNE, department.

Arr. of Poitiers. Cathedral church of Poitiers;[11] church of Notre-Dame-la-Grande at Poitiers;[1] church of Moustier-Neuf; abbey church of S. Hilaire, do;[2] church of S. Radegunde, do;[3] church of Fontaine-Lecomte; abbey church of Liguge; church of Nouaille; church of Lusignan.

Note 11.p.193. Church built at end of 12 th century according to the Romanesque traditions of Poitou, but with forms a already Gothic. Beautiful construction. Simple plan. (Art. Cathedrale, Figs. 44, 45). Facade of end of 13 th century.

Note 1.p.194. 11 th and 12 th centuries. Facade of the latter epoch, entirely covered by sculptures. paintings in the interior.

Note 2.p.194. Church of 11 th century, formerly vaulted in domes, now much mutilated. Beautiful plan, vast and well conceived.

Note 3.p.194. Church of 13 th century. Paintings in the interior, restored recently. Crypt.

Arr. of Civray. Church S. Nicolas of Civray; abbey church of Charroux;[4]

Note 4.p.194. Vast church terminated by a rotunda, 12 th

century, now in ruins. (Art. Saint-Sepulchre).

Arr. of Montmorillon. Church of Montmorillon; church of Antigny; church S. Pierre at Chauvigny; church Notre Dame, do.; church of la Puye; abbey church of S. Savin.[5]

Note 5.p.194. Porch of 9 th century! nave of 11 th; choir of beginning of 12 th. Spire over porch from 15 th century. Paintings in the interior from 12 th century. (Art. Architecture Religieuse, Figs. 11, 12). Style Romanesque of Poitou.

VIENNE, HAUTE, department.

Arr. of Limoges. Cathedral church of Limoges.[6]

Note 6.p.194. Porch of 9 th century, ruined nave of 11 th; choir of 13 th and 14 th; transepts of 15 th.(Art. Cathedrale, Fig. 47).

Arr. of Bellac. Abbey church of Dorat.[7]

Note 7.p.194. Beautiful church of 12 th century. Mixed style of Auvergne and of western coasts.

Arr. of Rochechouart. Church of Rochechouart; church of S. Junien; church of Solignac.[8]

Note 8.p.194. Style of Perigord. 12 th century. Domes.

Arr. of S. Yriex. Church of S. Yriex.

VOSGES, department.

Arr. of Epinal. Church of Epinal.

Arr. of S. Die. Cathedral church of S. Die;[9] church of Moyenmoutier.

Note 9.p.194. Nave from 11 th century, repaired in 12 th. Square apse of end of 13 th century.

YONNE, department.

Arr. of Auxerre. Church S. Etienne at Auxerre (old cathedral);[10] church S. Pierre, do.; church S. Germain, do.;[11] church S. Eusebe, do.;[12] church S. Florentin, do.;[13] abbey church of Pontigny;[14] church of Chitri-le-Fort; church of Moutiers; church of Chablis; church of Vermonton; church of Mailly-le-Chateau.

Note 10p.194. Beautiful Burgundian choir of 13 th century, with a single square chapel in the chevet. Transepts and nave of 14 th and 15 th centuries. Lower parts of the facade from end of 13 th century; upper parts of 15 th. Glass. Crypt of 9 th century. Paintings in the crypt.

Note 11.p.194. Crypt from 9 th century, much mutilated; choir of end of 13 th; nave destroyed. Tower of 12 th century.

Note 12.p.194. Nave of 11 th century, much mutilated. Facade of 13 th; choir of 16 th. Stained glass. Tower of 12 th cent.

Note 13.p.194. Choir of 16 th century. Stained glass.

Note 14.p.194. Great church of order of Citeaux. Nave of 12 th century, with porch; choir from beginning of 13 th.(Art-. Architecture Monastique, Fig. 8).

Arr of Avallon. Church S. Lazare of Avallon; church S. Martin, do.; abbey church of S. Madeleine at Vezelay;[1] church of S. Pere sous Vezelay;[2] church of Civry; church of Montreal;[3] church of Pontaubert.[4]

Note 1.p.195. Great church of order of Cluny. Nave of end of 11 th century; closed narthex from 12 th; choir and transepts of end of 12 th century;. Four towers formerly. This church is at the head of the great school of Burgundy.

Note 2.p.195. Pretty little church of 13 th century; style pure Burgundian. Charming tower. porch open, built in 13 th centurn and partly rebuilt in 14 th. Choir of end of 14 th. Three radiating chapels. No transepts.

Note 3.p.195. One of the purest churches of the Burgundian style of end of 12 th century; built at one spurt. Square apse, flanked by two square chapels. Transepts. Gallery.

Note 4.p.195. Little church of 12 th centurw in pure Burgundian style.

Arr. of Joigny. Church S. Julien-du-Sault;[5] church of Villeneuve-le-Roi;[6] church of S. Fargeau.

Note 5.p.195. Stained glass of 13 th century.

Note 6.p.195. Church of 13 th century. Mixed style of Burgundy and of Champagne.

Arr. of Sens. Church S. Etienne (cathedral of Sens);[7] church of hospital of Sens;[8] church Ss. Savinien and Potentin, do..

Note 7.p.195. Church from middle of 12 th century, originally without transepts, almost entirely rebuilt in 13 th. (Art. Cathedrale, Fig. 30).

Note 8.p.195. Choir of 13 th century. Mixed style of Champagne and of Burgundy.

Arr. of Tonnerre. Churcr S. Pierre of Tonnerre; church of Hospice of Tonnerre;[9] church of Neuvy-Saultour.

Note 9.p.195. Great church with a single nave covered by a carpentry, with little vaulted apse; 13 th century.

EGOUT. Sewer. Drain.

EGOUT. Sewer. Drain.

A subterranean conduit of masonry designed to carry off rain and waste water. The Romans were great builders of sewers, and when they built a city, they first thought to establish these subterranean services. When the barbarians became possessors of gallo-roman cities, they did not think of maintaining the ancient sewers, which were soon clogged or lost; the cities then contained actual cesspools, the stagnant water t then penetrated into the soil, the streets were infected, and pestilence periodically decimated the people. Men commenced by opening trenches in the middle of the principal streets, deep and walled streams, which were covered by slabs or left open. Storms had the care of cleansing these deep channels encumbered with deposits of all sorts. It was scarcely in the 12 th c century that men returned to the ancient system, and constructed sewers of masonry under the principal streets of cities. Corrozet speaks of sewers found opposite the Louvre, when that palace was rebuilt in 1538. There existed beneath the university quarter of Paris sewers Sprobably Roman), that were long utilized and rebuilt in 1412 (Sauval), because they were beyond service. We have frequently seen in making excavations of the vicinity of edofices of the middle ages remains of sewers constructed bo beautiful cut stones. The religious establishments and the feudal castles were already equipped with well arranged and constructed sewers after the end of the 12 th c century. It frequently occurs, that these sewers are practicble for men. When mansion Tremoille at Paris was demolished in 1840, there was discovered in the gardin a primary sewer, that seemed very ancient, and that presented the section indicated in Fig. 1. That sewer was traversed by another more modern (probably of the 12 th century;2), which was composed of a series of round arches, on which rested very thick slabs. These slabs were worn as if they had been long exposed to the passage of wagons, horses and persons on foot; they were on a level with a pavement of small blocks of sandstone. Under the palace of justice of Paris and beneath the site of the o old palace of the bishop, there still exist sewers that date from the epoch of S. Louis and of Philip the Fair. They are built of hard stone with great care and are covered by round tunnel vaults, paved with slabs at the bottom with a width of

about 2.5 ft. However sewers were rare in the cities of the middle ages compared with the number and extent of the streets, they were scarcely constructed except beneath the principal streets ending at rivers, with openingr at the level of the ground to water of the streams entering these streets at right angles.

~~EMBRASURE.~~ Embrasure. Porthole.

An opening pierced in the wall of a fortress or in a crowning parapet for placing the mouth of a cannon. Embrasures then only appear in military architecture at the moment, when a regular use was made of cannon for defense of places. Wa have said elsewhere (Art. Chateau), that at the end of the 15 th c century without notably changing the general arrangement of t the defenses; men were content to pierce in the ground story of the curtains of towers openings for striking the exterior by a sweeping fire, or to place guns at the tops of towers, whose roofs were suppressed to establish platforms with parapets. The castle of Bonaguil, which dates from the reign of Louis XI, possesses at the base of the ramparts some embrasures whose arrangement and form are indicated in Fig. 1. The muzzle of the gun is nearly at the middle of the thickness of the wall, as shown by the plan A. At the interior of the wall B, the embrasure is arched and is closed by a thick slab pierced by the round hole with a sight opening. On the exterior C is seen only the hole of sight opening with a splay allowing the gun to be pointed to right or left. The outer part of this sort of embrasure was rapidly injured by the blast of the gun; thus men thought of giving it more space (2), covering the external splay by an arch. Or indeed also as in the casemate batteries of the great rampart of Schaffhausen (3), the architects advanced the mouth of the cannon nearly to the external surface, forming inside a vaulted chamber, arrangiug the external splays in oval form with curved recesses, to turn aside the projectiles thrown by the assailants. These precautions in detail could only be efficient while the enemy did not place in battery great pieces of artillery, and had at his disposal only muskets or very small guns. Yet these kinds of egbrasures were employed also for covered batteries until the beginning of the 16 th century.[1]

Note 1.p.198. Art. Boulevard, Fig. 5., an embrasure arranged for oblique fire, with reserved piers intended to protect the artillerists.

Military architects sought combinations, that could facilitate oblique fire at the same time that they protected the men serving the guns; but the artillery made rapid progress. At the beginning of the 16 th century, besieging armies already possessed cannon of great calibre, that one shot ruined such too weak defenses, for it is stated, that from the moment when artillery became in general use, defensive means were inferior to the ever increasing power of that arm. One should not be surprised if the first fortifications built to resist cannon present a singular variety of defensive means, all very ingenious and very subtle, but soon abandoned as insufficient, to be replaced by others scarcely less so. Thus in the fortifications built by Albert Dürer at Nuremberg, we see embrasures of covered batteries (4), that permit pointing a cannon and obtaining a plunging fire and oblique fire for musketeers.

At Munich exists on the front of the brick gate Carlsthor, that dates back to the beginning of the 16 th century, embrasures arranged for an oblique and plunging fire (5), intended for small guns. At the Laufer gate of Nuremberg, along the external rambart one notices still embrasures designed for small cannon, whose openings are protected by small wooden cylinders, pierced by holes, like the battlements of one of the gater of Basle in Switzerland. (Art. Creneau).[1] In France these crafty means, a tradition of the military arts of the middle ages, were quickly set aside; men adopted by preference for covered batteries deep embrasures, fresenting a small open angle, leaving only a hole for the muzzle with a sight, on the exterior showing only a wide hole occupying the height of a course (7), sometimes with a bottmo slope when a plunging fire was desired. That method was habitually followed in Italy from the first y years of the 16 th century.

Note 1.p.200. A gives the plan of the embrasure, B its internal elevation, C the horizontal section of the wooden cylinder, and D its form and dimensions.

As for the embrasures of batteries not covered, Albert Dürer built those at Nuremberg as indicated by Fig. 8 in the curtains of some of his ramparts. The wide stone parapet preseots

[illegible]
ection. A shutter pivoted on an axis protected the gunners while the gun was loaded. These shutters were sufficiently t [illegible] its upper surface, for then the direct fire was weak because of the bad quality of the powder and the bad proportions of the guns, the chamber being too large a diameter for the load employed.

Sometimes in France and Italy men had the idea of making the embrasures as indicated in Fig. 5 in order to prevent projectile balls from sliding on the surfaces of the splays, and entering the gun. It is unnecessary to state that these splays were quickly destroyed by the artillery of the besiegers, and soon enlarged by the blast of the cannon. From the epoch of Francis I, when it was desired to arm a fortress, men used to crown the ramparts and curtains by earth pieces mixed with pieces of wood or straw. In case of siege embrasures were opened in this slope (13), and their vertical surfaces were maintained by planks. This method is still followed in our days. If necessary the height of the parapet was increased by gabions or bags of earth. Sometimes even these parapets with their embrasures were made of triangular wattlework placed together, [illegible] particularly employed for works in advance built in haste, when men did not wish to [illegible].

As today, military engineers were occupied in masking embrasures while the guns in battery were loaded. For that purpose were employed outer mantlets, shutters sliding in grooves, or low curtains. Of all these means, that most ingenious is that given by us (17). At A is seen the wooden platform covered with planks on which rolls the gun in battery. Against the internal surface of the parapet is placed the frame B, furnished in its upper part with a triangular shutter swinging on an axis, and moved by two levers C. The gun being loaded, men pulled on these levers when it was necessary to aim; as soon as the ball started, the shutter was dropped and by its own weight resumed its vertical position.

Embrasures have in all times greatly occupied engineers and [illegible] returned to wickerwork, to earth forms for batteries not covered,

a convex surface to better resist the effect of hostile projectiles. A shutter pivoted on an axis protected the gunners while the gun was loaded. Those shutters were sufficiently t thick and solid, that balls coming horizontally woud bound on its upper surface, for then the direct fire was weak because of the bad quality of the powder and the bad proportions of the guns, the chamber being too large a diameter for the load employed.

Sometimes in France and Intaly men had the idea of making t the embrasures as indicated in Fig. 9, in order to prevent hostile balls from sliding on the surfaces of the splays, and st striking the gun. It is unnecessary to state that these angles were quickly destroyed by the artillery of the besiegers, and even changed by the blast of the cannon. From the epoch of F Francis I, when it was desired to arm a fortress, men came to crown the ramparts and curtains by earth slopes mixed with p pieces of wood of straw. In case of siege embrasures were opened in this slope (10), and their vertical surfaces were maintained by planks. This method is still followed in our days. If necessary the height of the parapet was increased by gabions of bags of earth. Sometimes even these parapets with their embrasures were made of triangular wattlework placed together, and filled with earth and rubbish (14). These means were particularly employed for works in campaign built in haste, when men did not pile up terraces.

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[illegible]

nst siege batteries, and since the 16 th century the art of fortification in that respect has not made sensible progress.

ENCEINTE. Enclosure. Wall. Palisade.

Palisade enclosures surrounding a city, market town or camp. According to Caesar, the Gauls built the enclosures of cities, villages or fortified camps, by means of trunks of trees mixed with stones. The Germans composed them of wooden palisades [illegible] so as to form an actual wall well adapted to resist the effects of the battering ram; even fire had little effect on these works, almost always wet. The Romans in their winter camps (permanent camps) employed nearly the same procedure, or contented themselves with a bank of earth crowned by a palisade and externally protected by a ditch. The gates of these camps were usually protected by a sort of advanced work,(clavicula), much resembling the barbicans of the middle ages (1). At A were wooden bridges over the ditch, and at B the gate of the camp. This combination of stone and wood employed in the enclosures of cities or Gallic camps gave the idea to some peoples of this country to obtain vitrified ramparts, consequently of complete durability and coherence. There exists at 17.5 miles from P. [illegible] an oval enclosure composed of granite, clay and trunks of trees, that they succeeded in vitrifying by setting fire to the wood after having surrounded the interior with fagots.

We give at (2) a section of that enclosure, called of Peron. They commenced by making a wall of pieces of granite mixed with trunks of trees A; on the exterior this wall (vallum) was covered by a layer of clay B, and the whole must have been covered by a considerable quantity of fagots to which fire was set; the granite was vitrified and melted together; the clay has formed a solid mass adherent to that vitrified mass; a ditch and little wall of earth C protect the exterior of that singular enclosure. We know no other example of this kind of intrenchment in France; it is claimed that some exist in Ireland and in the north of Scotland.

[illegible]

As for embrasures of covered batteries or casemates, no system has yet been found that offers guarantees of durability against siege batteries, and since the 16 th century the art of fortification in that respect has not made sensible progress.

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In the first times of the middle ages, many cities in France

only had enclosures of wood. At the epoch of the invasions of the Normans was to be seen a great number of them, to which the barbarians evidently set fire. Men then in a manner rep-laced these fragile defenses by masonry walls; but the fires of boats and the facility with which wood could be procured in great quantity caused that for a long time many cities in the north were only enclosed by palisades of wood with or without terraces. When once they built masonry walls in the 11 th and 12 th centuries, wood still filled a very important place in these defenses, either to equip their tops, or to form exter-nal enclosures outside the ditches, before the gates, bridges and the extremities of suburbs.

During the wars of the 15 th century there is frequent men-tion of market towns simply defended by enclosures of palisa-des. "And then they came to Clermont and took the city," s says Pierre de Fenin,[1] "that was enclosed by palisade and dit-ches." Froissart [2] also speaks of several cities with enclos-ures in his time, only composed of palisades with wooden sheds and ditches.

[1] [illegible] p. 319. (1422).

[2] Froissart, p. 202. Book II. *The cities of Poperinghe, S. Venant in Flanders, Berghes, Bourbourch, are mentioned by this author as being enclosed only by palisades and ditches.*

Many cities during the middle ages were open, for to enclose them it would have been necessary to obtain the permission of the sovereign; and as the construction of these enclosures was obligatorily at the cost of the citizens, the urban popula-tion was not always rich enough to incur such great expense. In time of war the cities were enclosed in haste to protect themselves from a sudden attack or to serve as a support for an army corps. (Old French text).[1] Just as the Roman armies and the western armies of the middle ages built walls around their camps, when they desired to hold a country, or provinces, or to have a base of operations. (Old French text).[2] The wooden enclosures built outside the walls of strong places were des-ignated in the 12 th century by the name of "Gros rollets," [illegible] The spaces left between these outer enclosures and the masonry walls were called the lists.

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Note 1.p.206. Memoirs. Collection Michoud. Poujoulot. Vol.2. p. 614. (1422).

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Note 1.p.207. Hist. du ducs de Normondie et des rois d'Angleterre, from two monuscripts of Imp. Lib. (13 th century). Pub. by Soc. d.l.hist. d. Fronce. 1856.

Note 2.p.207. Gerord de Roussillon. Edit. of beginning of 16 th century. Lyons. Reprint ot Lyons. Louis Pessin. 1856.

Note 3.p.207. Li Romon de Gorin. Vol. I. p. 231. Edit. Techener. 1833.

Note 4.p.207. The some. Vol. II. p.172.

An enclosure of a city was not regarded as very strong only when it was double; when they could not construct two walls flanked by masonry towers, they at least arranged palisades w with ditches before the masonry enclosure, yet so that the internal wall could always command that external enclosure, and that it was distant only a short shot of a crsssbow. If the external enclosures were of masonry, flanked by towers and f furnished with barbicans, these towers and barbicans were open on the side next the city, open at the gorge, as it is now said, so as to prevent the besiegers from establishing themselves there after taking possession of them.

When one desires to consider the means of investment and of attack of strong places in the middle ages, it is perfectly evident of what value were the outer enclosures; thus was attached to them great importance. Between the two enclosures, a garrison had entire freedom of action to defend itself, to bring in assistance, or to take the offensive by making sorties. In the lists the besieged troops felt a strong protection behind them, they could throw themselves in mass on points attacked while relying on the internal walls, from which by their height men directed their efforts or protected their r retreat. Thus in the lists were placed their great war machines to compel the assailants to make works of approach, slow and hard to push forward on a stony soil. If the enemy took possession of a curtain or an external tower, the besieged fortified the lists by establishing two traverses at right aud left of the attack, that could prevent the besiegers from approaching the inner enclosure. (Arts. Architecture Militaire, Barbacane, Chateau, Porte, Siege, Tour).

In the cities were frequently found several adjacent enclosures, as well as most cloisters of cathedrals; castles, palaces and even certain quarters were enclosed by walls, and th their gates were closed at night.

ENCLOSURE. Wall. Palisade. (Art. Cloture).

ENCORBELLEMENT. Corbelling. corbel.
System of construction in stone or wood formed of superposed corbels, and that permits supporting a load overhanging the face of the wall, pier or buttress. One says construction by corbelling to designate a structure placed on a corbelling. (Arts. Construction, Figs. 40, 81, 82, 96, 101, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137; Echauguette; Machicoulis.

ENDUIT. Coating. Plastering. Stucco.
A covering of mortar, plaster or lime putty, placed on masonry of rubble, brick, even sometimes on cut stone, to obtain a uniform and homogeneous surface, suitable to receive paint.
The Greeks placed coatings on all their structures, exteriors as well as interiors, unless they were made of white marble. Also they colored the last material to avoid the cold and uniform surface of a single color, and to distinguish the different architectural members. The coating placed on their structures of cut stone, however well dressed they were, is very thin, (.004 or .008 in.), and is always colored.[1] All the joints and beds of the structure were thus concealed under this light covering. The Romans excelled in the art of preparing and applying coatings. Great edofices as well as private houses were constructed of bricks and concrete, and they faced their external and internal surfaces with slabs of marbel and plaster in several layers, a thick one first, then a thinner and a last very thin one, well smoothed, polished and covered by paintings. In the first times of the middle ages men desired to imitate this procedure; but the barbarians did not know how to make good lime, and knew still less about using it. Hence the plastering found on some rare monuments of the Merovingian and Carlovingian epochs is friable, blown and badly smoothed. Only in the 12 th century was plastering done with care; yet it is not to be compared to that of the Romans.
It must be stated that the syutem of construction adopted by the architects of the middle ages did not accept plastering, except on rough rubble; these architects after the 12 th century but exceptionally placed plastering on cut stone, that m must be painted and allowed to show its surface. On the intra-

interiors of vaults made of rough rubble, like those of the e [illegible] exhibited there, was plastering applied, and then it was always covered by paintings (see Paintings).

In houses and interiors of castles however, they spread a very thin coating, even on cut stone. Thus were finished the walls of the castle of Coucy, that date from the beginning of the 13 th century, so as to conceal the joints and to place the paintings on smooth surfaces. But these coatings, quite similar to the fresco stucco, are only a thick coat of lime and very fine sand laid with the brush and compressed by means of a small float. The colors were applied on this coating while it was still damp, then waxed and heated when the whole was perfectly dry; a procedure that recalls the ornamental painting of the ancients. From the 12 th century in interiors were employed coats of plaster, either on masonry walls, or on half timber work as partitions. These coats of plaster are generally very firm, very thin and placed on a coat of plaster into which always enters coarse sand. We have seen such plastering [illegible] a number of glittering particles at a fracture.

Note 1.p.265. The frescos & the temples of Sicily and Paestum have retained numerous traces of an extremely fine stucco, that appears to be composed of lime and marble dust.

The coatings of lime only were made and are still made of lime, fine sand or stone dust with the hair of cattle. When not exposed to dampness and applied on a good ground, this stucco lasts a long time; but it never acquires hardness. It has no advantage except not costing dear and being very light.

[illegible]

The abode of the damned is usually represented in paintings and sculptures of the middle ages by a monstrous mouth in which the condemned are swallowed. In the office of the dead is read this passage:- "Free me, Lord, from eternal death, from the infernal jaws, from the mouth of the lion," etc. The early artists translated the text literally. On the lintel of a [illegible] from the 13 th century, is indeed seen in the last judgment beside the damned, two hands that grasp the resurrected. As

intrados of vaults made of rough rubble, like those of the e edifices of Burgundy and the centre, on filling walls between engaged fiers, was plastering applied, and then it was always covered by painting. (Art. Peinture).

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Note 1.p.209. The Grecian stone temples of Sicily and Paestum have retained numerous traces of an extremely fine stucco, that appears to be composed of lime and marble dust.

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ENFER. Hell. Hades.

The abode of the damned is usually represented in paintings and sculptures of the middle ages by a monstrous mouth in which the condemned are swallowed. In the office of the dead is read this passage:- "Free me, Lord, from eternal death, from the infernal hand, from the mouth of the lion," etc. The early artists translated the text literally. On the lintel of t the principal portal of the cathedral of Autun, which dates from the 12 th century, is indeed seen in the last judgment beside the damned, two hands that grasp one resurrected. As

As for mouths denoting the entrance to hell, they are found on a number of reliefs and paintings. The idea of the classification of the damned in hell by kinds of punishments according to the causes of condemnation is an idea, whose trace is found very early in the monuments of the middle ages, and Dante has only given those traditions a poetic form, that summarizes in his work all that western artists have painted or sculptured on religious monuments. Indeed in the edifices of the 11 th and 12 th centuries, we see avarice, luxury, pride, idleness, etc., suffering in hell punishments proportioned to these vices. The avaricious are bent under the weight of bags of money hung on their necks; those that have abandoned themselves to the pleasures of the senses are devoured by obscene animals; the proud are driven at a gallop; toads attach themselves to the lips of calumniators, etc. (Arts. Jugement Dernier; Vices).

ENGIN. Engine. Machine.

This name is given to all machines; from this come the words engineer and machinist to designate the men charged with making, use and erection of machines, therefore the name engineer is given in our days to every person occupied with the erection of bridges, laying out roads, construction of shops, machines, ships, fortifications, etc.; also the name of engineering is given to the service.

Among the engines of the middle ages are machines employed for civil service, such as machines for hoisting or transporting burdens, cranes, crabs, windlasses, hydraulic machines and presses, then war engines, which are divided into machines for offense, for defense, and those for both offense and defense.

It is certain that the Romans possessed powerful machines for transporting and hoisting the enormous materials, that th they so frequently placed in their structures. Vitruvius gives us on this subject only limited and very vague information. The Greeks were very advanced in the mechanic arts; which cannot be surprising if one thinks of the knowledge, that they had acquired in geometry at a very ancient epoch, and that th they perhaps derived from the Phoenicians. Since antiquity t the mechanical powers have not advanced a step; only the applications of those powers are extended, for the laws of mechanics

are derived from geometry; these laws do not change after being once known; and among to many things here, that are given as truths, these are the only ones that cannot be doubted.

The ancients knew the lever, wedge, screw, inclined plane, windlass and pulley; as motor force they employed only the strength of man, that of the beast of burden, currents of air or water, and weight. They had no need like us, to economize the strength of men, since they had slaves, and they were ignorant of the modern forces produced by steam, expansion of gases and electricity. The middle ages inherited the knowledge left by the ancients without adding anything to it, until the epoch when the lay minds took the lead in the arts and sought new methods, at first by multiplying the known powers, and then by endeavoring to find other motive forces. Just as in seeking the philosopher's stone, the alchemists of the middle ages made precious discoveries, and the mechanicicians a and geometers while seeking perpetual motion, the aim in their labors, solved interesting problems, that were unknown before them or perhaps forgotten; for we are disposed to believe that the Greeks being endowed with a marvellous activity of mind, the motive forces of their time alone being accepted, had carried the mechanic arts as far as possible.

ENGINS APPLIQUÉS A LA CONSTRUCTION.

Engines applied to construction.

We see in the manuscripts, reliefs and paintings of the 9 th to 12 th centuries, the wheel and axle, gear wheel, steelyard, the various applications of the lever and inclined plane. We cannot exactly determine the epoch of the invention of the jack, but already in the 14 th century its principle is entirely adopted in certain war machines.

Further, everyone knows the principle of mechanics, viz:- that the amount of movement of a body is the product of its mass by its velocity, i.e., the space passed over in a given time; once that this principle was recognized, the different applications must naturally follow with more or less skill. In Romanesque structures, one rarely sees any but little materials employed, materials that were carried either on the shoulder, on a barrow by means of pulleys, or by employing the wheel and axle that laborers turned by their weight.(1). That primitive machine is still employed in certain depart-

departments of the Gentre and West of France; it is powerful when the wheel has a diameter of 20 ft, like that drawn in t this example, and that can be turned by the weight of three men; but it has the inconvenience of occupying much space, is difficult to transport, and it does not allow regulation of the movement of hoisting, as can be done with the machines of our time employed for the same purposes. The only means of g giving great power to the motive forces formerly known was to multiply them by the lengths of levers. Thus during the middle ages and in antiquity, the lever played the principal part in the manufacture of machines. The Romans had hoisted blocks of stone of enormous volume to a great height, and they daily set up monolithic columns of granite or marble 6.6 ft. diameter at the base by 49.2 to 59.1 ft. in height. The Phoenicians and the Egyptians had done much before them; now such rerults could only be obtained by the power of the lever and the very extended and perfected applications of this primitive m means.

For example, one understands what power a machine might have if arranged like this. (2). Let A B be a monolithic column p placed on an inclined bed with at C an axis rotating in a longitudinal groove sunk in a great block of wood E, that is fastened in X when the bed is in place; fastened on the axis of the inclined timbers, let there be two shears C D, connected at their top D, as shown by the sketch P; let there be wooden shores G, then a system of rope shrouds H strongly fixed by keys; let there be along the shears the pullies K', and on t the ground and fixed to the two longitudinal timbers other c corresponding pulleys L, the latter sending the cables to two capstants placed at a distance. It will be necessary for the monolith A B, however heavy it may be, to describe the circular arc and take the position a b; below its lower bed will be placed small blocks or a good bed of mortar, and gradually s slacking the cords holding it, it will slide on the timbers and set itself on its base M. It is only necessary to have shears of dimensions proportioned to the height of the block to be raised, and a number of pullies or tackles corresponding to the weight of the block. This is the same principle that was adopted from time immemorial in the construction of l little drays (2 bis) suitable for raising and transporting g

great wooden timbers.

But is very rare for the architects of the middle ages to use monolithic columns of dimensions to require such means. To erect monolithic columns like those of the cathedral of Mantes, the church of Semur-en-Auxois, choir of Vezelay, cathedral of Langres, etc., the architects could only employ t the lever windlass, that we have seen represented in stained glass and the vignettes of manuscripts. This lever windlass, in spite of its volume, could be transported on rollers, and if it only concerned hoisting the columns of a sanctuary, it was only necessary to move it to place its axis normal to the curve of the chevet.1

Note 1.p.214. The engineers of the middle ages were not embarrassed in moving enormous carpentry works after being pinned together; we shall have proof of this immediately.

Here (3) is one of these machines that we have endeavored to make practical, for the sketches given in the old paintings are so naive, that one must regard them as a conventional indication, a sort of hieroglyph. At A is seen the plan of the machine, whose horizonta, windlass B is so arranged as to be able to coil up two ropes. The elevation D of this machine shows one of the two circular disks C of the plan, which have on each of their faces eight movable teeth, whose detail is presented at G in side and front. The great levers E are forked and straddle the vertical disks, left to themselves, these levers take the position K L, their ends striking the crossbar L because of the counterpoise I. Then the teeth M falling to the lower part of their gain by their own weight and the position of their axes, oppose a stop to the end of the lever at the fork; the men have ascended the ladder N, placing their feet on the crossbar O and pulling on the rods, as indicated by the person sketched on our elevation, make the end of the lever descend to O′. The disk has thus made one-eighth of a revolution, and the ropes are coiled on the axle. leaving the crossbar O, the lever rises to its first position by the action of the counterpoise; the men ascend to place themselves on the crossbar, and thus continue. The ladder N of the crossbar O occupies the entire width of the machine between the two l levers, and at least six men could place themselves on that crossbar as indicated by the detail P, and give to the levers

a very considerable power, because these men not only act by their weight, but by lifting on the rounds. In the detail G we have sketched at R one of the teeth dropped, and at G is the corresponding tooth raised. This sort of movable gearing, opposing a resistance in one direction and annulling this in the other, assuring their function of a tooth by the position of the wheel, are very common in the machines that Villard of Honnecourt gives in several examples of them, among others in his wheel with unequal hammers, by means of which he claims to produce rotation without the aid of any outside motor force.

The screw jack, that machine composed of strong horizontal timbers through which pass two great wooden screws, with a v vertical frame connecting them, was employed during the middle ages to raise very considerable weights, and must have preceded the jack. Villard of Honnecourt gives on of these machines,[1] whose power is superior to that of the jack, but it is also much more bulky (40). A great vertical wooden screw is terminated at bottom by a capstan, passes through the timber A and turns by means of pivots fitted in the sill B and the cap C; two inclined timbers connect together the three horizontal timbers. Two vertical slides D receive, as in section E, a great wooden nut armed with iron loops supporting a ring with its lewis F. By turning the capstan, the nut is necessarily raised between the two grooves of the slides D, and thus one can raise enormous burdens, if the machine be of sufficiently great dimensions.

Note 1.p.216. Plate XLIII. See in the English edition of t the Album of Villard of Honnecourt, London, 1859, a fine description given by M. Willis of that machine. See French edition; Album de Villard de Honnecourt. Delion. 1858.

The use of inclined planes was very frequent in the structures of antiquity and of the middle ages; we have given a remarkable example of this in Art. Echafaud, Figs. 1, 2. Thus is avoided the danger of breaking cables in a time when iron chains were not employed to raise materials of great volume, and men did not need to use extraordinary motive powers. It is certain that by means of a plane inclined at 45°, for example (5), two pulleys being placed at the top A, two other p pulleys at D, and one or two capstants at D, the weight C being placed on rollers, much force is saved; but it is unneces-

unnecessary to state that this mode of raising materials suitable for construction can be employed only while the buildings attain a very moderate height; now edifices of the middle ages are often very high. Then for the construction of the upper work of these edifices, it appears that they employed the crab and the crane. There still existed at about the beginning of our (19 th) cintury on the south tower of the cathedral of Cologne, then carried about to the level of the high vaults of the nave, a crane carefully covered with lead, that dated from the 14 th century, i.e., from the moment at which the works were stopped. We posses no certain documents relating to that curious machine; we know only its general form, that recalls that of cranes still employed during the last (18 th) century. The materoals were brought to the foot of the work beneath the end of the crane by means of great drays with two wheels, as indicated by Fig. 6. A long tongue serving as a l lever, when the stone had been loaded on the platform A, permitted the raising of the platform by lowering the end B, and to roll the machine to the point at which the caple of the c crane could take the stone by means of the lewis.

These machines are still in use in the provinces of the South. Not more than 20 years since notable improvements were made in the system and manufacture of machines employed in construction; until then the machines used in the 13 th century were still used to transport materials from one point to another, or to hoist them vertically. The crab, that admirable and simple invention, that dates back to the highest antiquity, is still in use today, and it is probable that it will be employed for a long time.

ENGINS DE GUERRE. War Machines.

It is necessary to make our text clear by dividing machines according to their functions:- machines for attack, for attack and defense, and for defense alone.

Offensive machines before artillery. -- Vitruvius[1] speaks of three machines suited for attack; catapults, scorpions and balistas. catapults and scorpions are placed by him in the s same list, these machines were inteuded to throw darts of great length and considerable weight. Naturally the dimension o of the projectile gives that of the machine. The propelling motor consists of wooden springs strained by means of ropes

and windlasses. Unfortunately Vitruvius, who gives us the r relative dimensions of each part of these machines, forgets to describe their construction; so that it is difficult to o obtain a tolerably accurate idea of the system adopted. Perrault in his translation of the Latin text gives a represeutation of a catapult;[2] but we confess to not being satisfied by his interpretation. His motor could have but a very weak action, and would rather make the arrow wabble than send it in a straight line. Vegetius [3] speaks of ballistas, onagers, scorpions, and ballistas with bows; but his descriptions are of a brevity, that one can derive from them nothing conclusive; we only know from him that the ballista was bent by means of cords or sinews, that the scorpion was a ballista of small d dimensions, a sort of crossbow; "scorpions were what are now called hand ballistas;" that the onager cast stones, and that the strength of sinews must be calculated according to the w weight of the projectiles; but he avoids informing us if these onagers were machines set in action by counterpoises, stretched cords or springs. Commentators on these ancient authors a are more prolix as the texts are more brief or obscure; but they give us no practical solutions.

Note 1.p.219. Book X. Chaps. 15, 16.

Note 2.p.219. Plate 64.

Note 3.p.219. De re militari. Book IV. Chap. 22.

If Vegetius seems to indicate that the ballista was a great fixed crossbow suited to discharge arrows, Vitruvius claims that the ballista was intended to cast stones of a weight varying from 200 to 250 lbs.; he does not inform us whether the machine was moved by counterpoises or springs. The ballista g given by Perrault sent its projectile ten paces, if it did n not even fall on the carriage. Amminanus Marcellinus [4] is a little less obscure in the descriptions he has left to us of the offensive war machines employed in his time, i.e., in the 4 th century. According to that author the ballista is a sort of great crossbow, whose projectile (javelin) is driven by t the force of several stretched catgut cords. The scorpion, that was called onager in his time, is positively the caable of the middle ages, i.e., a michene composed of a bar with end between twisted cords, like the stick of a saw frame ((bucksaw), and whose head is fitted with a spoon that recei-

receives a ball which this bar throws like a bomb when loosed. Ammianus Marcellinus also designates this machine by the name of "tormentum", hoisted.

Note 4.p.219. Book XXIII. Chap. 4.

Our readers cannot blame us for adding nothing to texts so diffuse and inconclusive as the commentators on Vitruvius and Vegetius and Ammianus Marcellinus, they will prefer to permit us to pass to the study of machines of the middle ages, concerning which we posses data a little less vague.

Machines for attack, from the invasion of the barbarians t till the use of artillery are in great number; some are moved by counterpoises like the trebuchet and mangonels, others by the tension of cords, sinews, branches, springs of wood or of steel, like the caables, malvoisins and stone-throwers, others by their own weight and the strength of men, like montans, battering rams and bossars. Nothing indicates to us that the Romans before the 5 th century employed casting machines with counterpoises, while thew knew and used , as we have just stated, machines with springs, great crossbows turning on one or two feet, as one can assure himself by examining the reliefs of Trajan's column. Casting machines moved by counterpoises are a later invention than machines with springs, because machines with springs are only applied at a larger scale of a hand arm known from all antiquity, the bow. Machines with counterpoises require in their manufacture so many precautions and calculations, such powerful means, that one cannot admit that they were known to the barbarians that invaded Gaul. They must first have imitated the Roman war machines, then have d demanded from the Byzantines the very perfect inventions of the Greeks. Machines previously unknown are mentioned in the annals of S. Bertin, and which were erected before the walls of Angers, occupied in 873 by the Normans, had probably been imposted into France by the artists brought from Byzantium by Charles the Bald. The annalists and poets of those remote times, and even those of a more recent epoch, are hopelessly brief, when they speak of these machines, and they designate them by names taken by chance from the arsenal of war, for t the needs of the measure or rhyme, so that until the time of Charles V, when the chronicles become more precise and clear, there are certain machines to whom is given with difficulty

their proper names. Yet we shall try to discover the use and form of these different machines.

In the song of Roland, one reads:- Old French text). Now f for the walls to be battered or defaced by the cables, it m must be admitted that the cables threw blocks of stone. Hence it was a stone-thrower. "A great stone-thrower called castle, so great --." [1] Guibert of Nogent in his histoire des Croisa-des,[2] speaks of the numerous ballistas, that were built around the walls of the city of Caesarea by the army of the Christians. These cables and these ballistas seem to us to be an imitation of the machines with springs in use by the Romans and perfected by the Byzantines. It is certain that these machines ines cast with fury the largest stones, "which not only struck t the external walls, but often carried their shocks to the highest palaces in the interior of the city." These ballistas were placed on wheels and could thus be changed in place according to needs; besides that was a Roman tradition, for on the reliefs of the column of Trajan are seen some of those machines placed on wagons drawn by horses. Many authors have attempted, basing themselves on the painted or sculptured representations of the middle ages, to give an account of t the construction of these casting machines; but these sketches representations seem to be not practical and to resemble the naively conceived sports of children. Yet their effect, although not to be compared to that produced by artillery, caused such disorder in the fortifications, that it is indeed necessary to believe in their power, and to attempt to give an accurate idea of them. That is what we devote ourselves to in the following illustrations, and which while respecting t the general information supplied by the vignettes of manuscripts and the reliefs, are studied as if it were necessary to proceed to their construction. It is well understood, that we have adopted only the mechanical procedures known to the mechanical engineers of the middle ages.

Then here is first one of those machines, a ballista, castle or stone-thrower, moved by springs and stretched ropes, intended to cast stones. (7). The principal timber is the beam A, whose lower end passes through a group of ropes twisted by m

their proper names. Yet we shall try to discover the use and form of these different machines.

Note 1.p.120. See Cobullus, Boltsto. Duconge. Gloss.

In the song of Roland, one reads:- Old French text). Now f for the walls to be battered or damaged by the caables, it m must be admitted that the caables threw blocks of stone. Hence it was a stone-thrower. "A great stone-thrower called caable, so great --." [1] Guibert of Norgent in his histoire des Crusades,[2] speaks of the numerous ballistas, that were built around the walls of the city of Cesarea by the army of the Christians. These caables anf these ballistas seem to us to be an imitation of the machines with springs in use by the Romans and perfected by the Byzantines. It is certain that these machines had great power, for the same author relates that these machines cast with fury the largest stones, "which not only struck t the external walls, but often carried their shocks to the highest palaces in the interior of the city." These ballistas were placed on wheels and could thus be changed in place according to needs; besides that was a Roman tradition, for on the reliefs of the column of Trajan are seen some of those machines placed on wagons drawn by horses. Many authors have attempted, basing themselves on the painted or sculptured representations of the middle ages, to give an account of t the construction of these casting machines; but these sketched representations seem to be not practical and to resemble the naively conceived sports of children. Yet their effect, although not to be compared to that produced by artillery, occasioned such disorder in the fortifications, that it is indeed necessary to believe in their power, and to attempt to give an accurate idea of them. That is what we devote ourselves to in the following illustrations, and which while respecting t the general information supplied by the vignettes of manuscripts and the reliefs, are studied as if it were necessary to proceed to their construction. It is well understood, that we have adopted only the mechanical procedures known to the mechanical engineers of the middle ages.

Then here is first one of those machines, a ballista, caable or stone-thrower, moved by springs and stretched ropes, adapted to cast stones. (7). The principal timber is the beam A, whose lower end passes through a group of ropes twisted by m

[illegible]

The ropes are passed in two bands attached to the shaft to which the toothed wheels are fastened, as indicated by the detail D. These cords of sinews twisted at pleasure at the lower end of the beam had a great force of recoil.[2] But to still increase the rapidity of movement to be taken by the beam, sorings of wood and sinews wrapped by cords formed two branches E of a bow attached to the cross stop, forcing the beam to strike violently that cross piece F, when by means of the windlass C this beam had been brought to a horizontal position. When the beam A had been brought as low as possible, a man pulled the cord H and allowed the escape of the iron rod I, (see detail K), and the beam was quickly brought to the vertical position, stopped by the cross stop F, and then sent after the projectile placed in the scoop L. The aim was regulated by adding or reducing the pads on the cross piece F, so as to cause the stop to advance or recede, or by attaching leather cushions stuffed with pads to the front surface of the beam. The greater the projection of the stop, the higher would be the aim; the less it was, the more direct the aim. The projectile obeyed the centrifugal force imparted by the rotary movement of the spoon and the horizontal impulse produced by the stop of the cross-piece F. The lower part of the beam pressed the section M, so as to prevent its deviation, and it was further kept in its place by the bolts of the two branches of the spring E. The hooks N served to fix the wheeled frame in place by means of ropes fastened to stakes driven in the ground, and to attach the ropes of beams, when it was necessary to draw it. Four men could pull down the beam by means of the windlass C. So that such a machine should not be rapidly ruined by the terrible shock occasioned by the beam striking on the cross stop, it was necessary for this cross piece to be reinforced by wooden struts and iron straps, as indicated by our fig. 7.

Note 1.p.291. Villion C. Jurs. Book VI. Chap. 15.

Note 2.p.291. Book VII.

Note 3.p.292. Everyone knows that joiners stretch saw blades by means of cords thus twisted and held by a wooden stick, and that has exactly the effect of the beam of our machine. (i.e. [illegible])

means of the wrench B and toothed wheels C, stopped by clicks. The ropes are passed in two bands attached to the shaft to w which the toothed wheels are fastened, as indicated by the detail D. These cords or sinews twisted at pleasure at the lower end of the beam had a great force of recoil.[3] But to still increase the rapidity of movement to be taken by the beam, springs of wood and sinews wrapped by cords formed two branches E of a bow attached to the cross stop, forcing the beam to s strike violently that cross piece F, when by means of the windlass G this beam had been brought to a horizontal position. When the beam A had been brought as low as possible, a man p pulled the cord H and allowed the escape of the iron rod I, (see detail K), and the beam was quickly brought to the vertical position, stopped by the cross stop F, and then sent afar the projectile placed in the spoon L. The aim was regulated by adding or reducing the pads on the cross piece F, so as to cause the stop to advance or recede, or by attaching leather cushions stuffed with rags to the front surface of the beam. The greater the projection of the stop, the higher would be the aim; the less it was, the more direct the aim. The projectile obeyed the centrifugal force imparted by the rotary movement of the spoon and the horizontal impulse produced by the stop of the cross-piece F. The lower part of the beam presented the section M, so as to prevent its deviation, and it was further kept in its plane by the pulls of the two branches of the spring E. The hooks O served to fix the wheeled frame in place by means of ropes fastened to stakes driven in the ground, and to attach the ropes of teams, when it was necessary to drag it. Four men could pull down the beam by means of the windlass G. So that such a machine should not be rapidly injured by the terrible shock occasioned by the beam striking on the cross stop, it was necessary for this cross piece to be maintained by wooden struts and iron straps, as indicated by our Fig. 7.

Note 1.p.221. William of Tyre. Book VI. Chap. 15.

Note 2.p.221. Book VII.

Note 3.p.221. Everyone knows that joiners stretch saw blades by means of cords thus twisted and held by a wooden stick, t that has exactly the effect of the beam of our machine. (Like a bucksaw).

A general elevation (8) shows the beam lowered by means of the windlass and the beam also striking the cross stop, as well as the start of the projectile from the spoon, the springs being stretched when the beam is down, and set free when it returns to its normal position.

Machines analogous to this also served to drive arrows; but we shall return to that soon in treating of great crossbows with cranks. We shall continue to survey the machines adapted to cast other projectiles like bombs.

Villard of Honnecourt [1] gives us the plan of one of these great stone-throwers with counterpoise so much employed during the wars of the 12 th and 13 th centuries. Although the elevation of this machine is lacking in the manuscript of our Picard architect of the 13 th century, yet the sketch presented by him and the added explanation cast a strong light on this sort of machines. Villard writes at the bottom of his plan t the following note:- (Old French text). [2, 3, 1] The plan given by Villard presents two parallel sills spaced about 8 ft. apart, each being about 34 ft. long. At 14 ft. from the front end of the sills is a cross-piece, which at the scale appears to be 25 ft. long; then four great braces, a S. Andrew's cross between the two longitudinal sills; near the rear end are the two windlasses accompanied by two great horizontal wooden springs. That is an enormous machine, and Villard is right in a advising care to be taken at the moment when the beam is loosed. We present therefore the perspective of this machine, th that our readers may receive a general idea of it. Villard o only gives us the plan of the sills on the ground, but a number of vignettes of manuscripts present us sufficient to complete the Fim. One of the important parts of the description by Villard is the volume of the counterpoise. These boxes are prisms, but portions of cylinders in most old representations; now in giving to this box the form indicated in Fig. 9 of the dimensions stated in the text of Villard, we find the volume of about 706 cu. ft. Assuming for 35.3 cu. ft. of earth a weight of 2646 lbs., we obtain 57,320 lbs. (28.66 tons). "There is a great weight to fall)" To lift such a load required levers of great length; the beam was that lever; it was 26.3 to 39.4 ft. long, composed of two timbers strongly bound together by iron straps and ropes, and receiving between them the iron a

axis made as indicated by detail A. The pivots of that axis entered the two vertical timbers B, reinforced and with iron straps at their ends, maintained in their plane by braces. In case of breakage of the axle a block C received the reinforcement C', to prevent the fall of the beam and all the damages that its fall might cause.

Note 1.p.224.See album of Villard of Honnecourt, pub. by M M Lassus and Alfred Darcel, (Paris. Delion. Edit. 1858), and the English edition,pub by M. Willis (Oxford. Parker).

Note 2.p.224. "If you wish to make a strong engine called trebuchet, pay attention here. Here are the sills as they rest on the ground. Here in front are the two windlasses and the double rope by which the beam is pulled down. Here is how it can be done on that other page. It is a great task to lower it, for this counterpoise is very heavy; it consists of a box filled with earth, 12.8 ft. long, I ft. wide and 12 ft. deep. And to loose the beam (with the pin), think to take care, for it must be kept at that front cross-piece."

Note 3.p.224. M M. Lassus and Darcel have translated "windac" by spring; it is employed in old Picard French for capstan or windlass, as a cylinder around which is coiled a rope. In his translation of Chapter "De balistarum rationibus" (Vitruvius. Book X. Chap. 18), Perrault uses the word "windas" in the sense of windlass and not that of capstan, today one still says "guinde" in the language of the theatre machinist to designate a small rope would on a horizontal cylinder or windlass, from which is "gunidre," which means to the machinist to bear on the windlass, i.e., to turn it in a manner to coil up the rope supporting a burden. Diego Vezzo in the Vraie instruction de l'Artillerie (Frankfort. 1615. p. 122, Fig. 24), gives a jack, that he calls "martinet" in French and "winde" in Flemish; then a crab for raising pieces, that he calls "gunidal". Then "windas" was not a capstan, as M. Willis believes, after the authority of La Hire and Felibien, authorities too recent to have some weight in these matters. M. Willis in the English edition of Villard of Honnecourt with reason removes the error made by the French commentators; but he concludes wrongly, as we think, that the "windas" are little capstans fixed on the front branches of Villard's plan, branches that are evidently springs, and which M. Willis in the engravings added to his

commentary adds connections omitted by Villard; on the contrary our author takes care to show that the two double branches are each of a single piece, and that they are made of natural forks. Further, the two horizontal windlasses "windas", mentioned and drawn by Villard, makes the function of the constant useless, and a rope coiled around a capstan could not first pass around a horizontal windlass, for then the capstan could not act, because of the resistance of friction offered by the rope coiled on the windlass. M. Willis must have assumed pulleys and not windlasses; but the drawing of Villard d does not indicate pulleys, except at the ends of the springs. The French commentators on Villard of Honnecourt, it seems to us, have understood the function of the two springs as independent of that of the two horizontal windlasses; those springs were very useful to force the beam to leave the vertical, at the moment when the men commenced to lower its end; for contrary to what M. Willis says, the greatest effort must occur when the pulling rope makes an acute angle with the beam; then the aid of the springs was really useful. Furthermore, our Figs. explain the action of the mechanism. As for the stop on the vertical piece that M. Willis believes to be the proper means to hold the beam when it is lowered, we shall first state that Villard indicates this piece on the horizontal plane, since this piece is too far from the plane of lowering the beam to be able to hold it. This means has nothing practical; this piece would be pulled up; how then could it be kept at the sill? Why would it not be drawn out of the vertical by t the stress of the beam? That bar indicated in the plan of Villard seems to us to be one of the levers of the first windlass, perhaps fitted with a ring at its end for passing a rope, so as to aid the lowering.

Note 1.p.225. MM Lassus and Darcel assume that here is a q question of the spear suitable to be thrown; the trebuchet do does not cast spears, but indeed stones, i.e., projectiles in full flight. M. Merimee has corrected this error and claims that the "fleke" must be taken as the beam of the engine. The opinion of M. Willis seems to us preferable; he claims that the "fleke" must be understood here as a shot; that the word "fleke" refers to the pin that holds the firing cord at the end of the beam, a pin that the master of the engine knocks

out by the stroke of a mallet. The English work click corresponds to the french word "declic". If the word "fleke" is undesstood for a projectile, the text of Villard would not have sense, while our author is perfectly correct in advising the men at the engine to take care at loosing the "fleke" i.e. to stand away, they might be killed by the recoil of the sling at the moment the beam describes its circular arc (Figs. 9, 10, 12). We do not pretend to have completely interpreted t the trebuchet of Villard, but we are compelled to make its working possible; generally when necessary to represent these old war engines, one does not apply to the details the scruples of practicians, required to execute a given programme. Of all these engines represented, we know none that could work; we have thought it would be well once to draw them, as if it were necessary to have them built before us, and to use them ourselves.

Let us see now this machine was worked, whose side elevation is given. (10). When the beam was freed, pulled by the counterpoise C, it took the vertical position A B. To bring it back from the vertical position required a greater pull because of the acute angle formed by the pulling rope with the beam; then one had recourse to the two great wooden springs t traced on Villard's plan and reproduced in our perspective v view (Fig. 9). The ropes attached to the ends of these two springs passed through the grooves of two return pulleys fastened on pins set in the second windlass D.(Fig. 10). In turning that windlass backward, the two cords were stressed as much as the tuo springs permitted. Previously the ring E with its twin pulleys F, through which passed the pulling rope, had been fastened to the staple G by means of the pin H.(See detail X). The pulley I rolled on a slightly bent rope K L so as to make the pull of the windlasses as direct as possible. At the moment when the beam was to be lowered, all being thus p prepared, a server having ascended to attach the double rope to the ring of the draft pulley, the windlasses were turned h backward and held by clicks, the springs tended to resume their position, one or two turns of the windlasses D were made in the direction for lowering, thus aiding the men who began to work on the two windlasses, which required far less force as the beam departed from the vertical. Then were detached the

rings of the cords of the springs, and they continued lowering on the two windlasses a b and a'b'. Right one (two to a lever for a machine like that represented in Fig. 10). From the instant that the beam left the vertical by means of the springs could bring it to the position A'F'. The loader took the leather pocket and rope V, placed them in a horizontal straight line at V', and laid in the projectile; then with a stroke of the mallet, the firer knocked out the pin E. The beam being no longer held, resumed the vertical position by a rapid movement and sent the projectile afar. Here is not given, for lack of experience acquired by practice, an exact account of the effect of the combined forces, of the revolution followed by the projectile, and the moment when it must leave its pouch. Some commentators have regarded the pouch of the projectile as an actual sling composed of two cords, one fixed and the other movable, so that by the movement of rotation imparted to the projectile, one of the two cords left its temporary point of attachment, and the projectile being then left to itself, described in space a more or less elongated parabola.

First, many causes might modify the loosening of one cord of the sling; the weight of the projectile, its more or less pull on one of the two cords, a slight obstacle or friction. It might happen to be loosed too soon, and then the projectile would be cast vertically and would fall on the heads of the men, or it might not be loosed at all, and then be thrown back violently against the beam, and might break it. On consulting the reliefs and vignettes of manuscripts, we do not see represented these two cords of the sling and the temporary attachment of one of them; on the contrary the cords of the sling appear to form only one group of cords or thongs, with a ring on at the end as indicated by our Figs. Further, we frequently see in vignettes of manuscripts a second attachment placed below the attachment of the sling, and which appears to hold fast, as shown by the vignette (11) represented in the French and English editions of Villard of Honnecourt. Here the tender holds by his hand that secondary fastening and seems to attach it to the end of the sling. This fastening, sub-cord, that in our Figs. 9 and 10 we have sketched at T, assuming it to be double, and that it could be attached at different points of,

rings of the cords of the springs, and they continued lowering on the two windlasses a b and a′b′. Eight men (two to a lever for a machine like that represented in Fig. 10), from the instant that the beam left the vertical by means of the springs could bring it to the position A′B′. The loader took the leather pocket and ropes M, placed them in a horizontal straight line at M′, and laid in the projectile; then with a stroke of the mallet, the firer knocked out the pin H. The beam being no longer held, resumed the vertical position by a rapid movement and sent the projectile afar. Here is n t g given, for lack of experience acquired by practice, an exact account of the effect of the combined forces, of the revolution followed by the projectile, and the moment when it must leave its pouch. Some commentators have regarded the pouch of the projectile as an actual sling composed of two cords, one fixed and the other movable, so that by the movement of rotation imparted to the projectile, one of the two cords left i its temporary point of attachment, and the projectile being then left to itself, described in space a more or less elongated parabola. 1

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the tail of the sling; we are going to see why.

Let (12) be the movement of the beam, when after being brought down, it abruptly assuemes the vertical position by the effect of the counterpoise; the projectile must describe the curve A B C. Now there occurs a moment when the sling will be normal to the circular arc described by the beam, i.e., when that sling will be exactly in the prolongation of the beam, which is the radius of that circular arc. Then the projectile being moved by a considerable centrifugal force, it will tend to escape from its pouch. It is clear that the sling will be more rapidly be brought into the line of prolongation of the beam as that beam is shorter, and that the weight of the projectile is greater. If the sling comes into the prolongation of the line of the beam, when that is at the point d of the arc of the circle, the projectile will not be cast toward the enemy, but on the contrary on those placed behind the machine. There is then a first calculation to be made to give the sling a desired length, so as to throw a weight (?); it reaches the prolongation of the line of the beam when that has nearly reached its highest point. But it is then necessary to determine by an abrupt shock the departure of the projectile, which otherwise would have left the radius while leaving the machine almost vertically. It was to produce this sh shock that was made the sub-cord P. If this sub-cord were attached at P′, for example, so as to form with the beam and t the tail of the sling the triangle P′O R, the tail O P′could no longer leave the angle P′O R, nor move on the point of rotation O. But the projectile C continuing its course forced t the pouch of the sling to obey that impulse until the moment when that pouch indeed reversed itself, the projectile being left to itself and was driven by the centrifugal force and t the impulse given by the abrupt check of the sub-cord to describe the parabola C′E.

It is indicated by the sketch S, that if the sub-cord P′ were attached at P″, i.e., near the fasteniug of the tail of the sling, forming the triangle P″O′R′ whose angle O′ is less obtuse than the preceding one, the shock would be felt sooner, the part of the sling left free would describe the circular arc C″C‴, or rather a curve C″C⁗, because of the principal movement of the beam; the projectile C⁗ left to itself with

the double movement of the principal centrifugal force and of the secondary centrifugal force caused by the stop P″, would be thrown in a parabolic line C″″E″ more nearly approaching the horizontal line than in the preceding case. In a word, the more the sub-cord is tightened and fixed near the attachment of the sling, the more nearly horizontal is the projectile cast; on the contrary, the looser is this sub-cord and attached near the poumh of the sling, the more nearly vertical will the projectele be thrown. These sub-cords were then a necessary means for regulating the aim and accuracy of flight of t the projectile.

If necessary to regulate the aim, it was also necessary to avoid the destructive effect of the counterpoise, that having reached the extreme limit of its fall must cause a terrible shock to the beam, or break all the connections of the struts. For that purpose, not only was the movement of the counterpoise double, i.e., this counterpoise was attached to two cranks with two pins, but also frequently to the cranks themselves were fixed overhanging weights, as shown in our preceding Figs. Here is what was the effect of these weights T. When t the beam was abruptly under the influence of the box filled with earth or stones, the weights T descending rapidly exerted a force on the cranks at the moment the box reached the extreme limit of its fall, where it was held by the opposed resistance of the beam. The weights not having to directly suffer the resistance continued to fall, inclining the cranks to a line g h, and thus partly destroyed the shock imparted by the abrupt tension of these cranks. The weights T decomposed to a certain point the vertical pull produced by the box, and neutralized the shock that would have broken all the pivots, nowise changing the rapid movement of the beam, by substituting friction on the pivots for a shock produced by an a abrupt tension.

These machines with counterpoises were in use up to the moment when cannon came to replace all the casting machines of the middle ages. The learned bibliophile M. Pichon possesses an account of what was paid for the transportation of one of these machines in 1378, that served at the siege of Cherbourg. Here is that curious document, that its possessor has courteously communicated to us:- "The master Thomin, citizen of Pon-

[illegible] ter carpenter and 4 other carpenters, 10 masons and laborers, 40 tenders, 31 wagons, including the wagon that carried the beam of the said machine; for three wagoners ordered to serve that machine at the siege of Quercorb, came to Carcassonne, and we, Ghabuain Chasmeton, doctor in the domain, the bailiff of Constentin, and John of Ties, bailiff there for the king our sire in lands that belonged to the king of Navarre, clerk and deputy in those parts, on account of our lords the generals sent by the king our sire for the said siege; the 15 th day of November, in the year 127[illegible]:- and first:-

The said Thomas, [illegible] master of the said machine, [illegible] expenses for 10 days, total-- ?.

Michel Bouffé, master carpenter of the said machine, 10 days, etc." 9

Then follows the account of the carpenters, masons, laborers, wagons and horses. This memorandum shows the importance of these machines, that required such a numerous body to place and work them. The number of 40 tenders sufficiently indicates the power of these engines, for assuming that they were divided in two shifts (their labor being very fatiguing), since they were charged with working the windlasses, they 20 tenders were required to pull down the beam of the trebuchet. The masons were probably employed to level the areas on which the machine was placed.[1] Pierre of Vaux-Cernay, in his Histoire des Albigeois, speaks of numerous mangonels erected by the army of crusaders before the castle of Termes, that cast against that place enormous stones, so that these projectiles made several breaches. At the siege of the castle of Minerve (in Minervois), says the same author, "There was on the part of the Gascons one of the machines called mangonels, in which they labored night and day with much ardor. Likewise at the south and north were erected two machines, i.e., one at each side. Finally on the side of the count, i.e., at the east, w was an excellent stone-thrower, that daily cost 21 livres for payment of the men employed there." At the siege of Castel-nary undertaken against Simon de Montfort, the count of Toulouse caused the construction of a machine of enormous size to destroy the walls of the castle, that cast enormous stones, and overthrew all that it struck. One day the count (Simon de

Pontorson, governor of the machine of the said city, the master carpenter and 5 other carpenters, 10 masons and laborers, 40 tenders, 31 wagons, including the wagon that carried the beam of the said machine; for three wagoners ordered to serve that machine at the siege of Cherbourg, came to Carentan, and we, Endouin Channeron, doctor in the domain, the bailiff of Costentin, and John of Iles, bailiff there for the king our sire in lands that belonged to the king of Navarre, clerk and deputy in those parts, on account of our lords the generals sent by the king our sire for the said siege; the 15 th day of November, in the year 1378:- and first:-

The said Thomin, the present master of the said machine, and expenses for 10 days, total-- ?.

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[illegible]) advanced to destroy the said machine; and as the e[illegible] [illegible] so that our men could not reach it." Indeed care was always taken to enclose these machines by barriers and wattles, both to prevent the enemy from destroying them and to protect the men that worked them. At the siege of Toulouse, Pierre of Vaux-Cernay relates, that in the combat where Simon de Montfort was slain, "the count and the few men that were with him retired because of a shower of stones and an insupportable cloud of arrows, that overwhelmed them, stopped before the machines and behind hurdles to shelter themselves, for the enemy cast on our men an enormous quantity of stones by means of two trebuchets, a mangonel and several machines." Then Simon de Montfort was struck by a stone cast by a stone-thrower worked by the women on Place S. Sernin, i.e., at least 640 ft. from the place that the combat occurred. Sometimes the early authors, as in this passage, seem to distinguish the trebuchets from the mangonels. The mangonels certainly were machines with counterpoises like the trebuchets, but the mangonels had a fixed load placed at the end of the beam instead of a movable one, that gave them [illegible].

Note 1.p.332. The importance of the construction of these machines may also be proved by consulting the old accounts and inventories of fortresses. When in 1428 was destroyed the machine placed on the tower of S. Paul at Orleans, to replace it by cannon, the carpentry of that war machine, that was either a trebuchet or a mangonel, filled 26 wagons, that were driven to the chamber of the city. (Lottin, Histoire du siège d'Orléans. [illegible]. 1. Paris. [illegible].

Villard of Honnecourt calls the machine with counterpoises a [illegible] by drawing, the counterpoise in the form of a box, a trebuchet: from which one may conclude that if the mangonel is also a machine with counterpoises, this can be only the pendulum machine, such as represented in the relief of S. Nazaire of Carcassonne,[1] and in many vignettes of manuscripts.[2]

Note 1.p.333. A relief supposed to represent the death of Simon de Montfort, and which is deposited in chapel S. Laurent of the church S. Nazaire of the city of Carcassonne.

[illegible]

We have seen that the sling of the trebuchet has its two

wontfort) advanced to destroy the said machine; and as the e enemy had surrounded it by ditches and barriers, so that our men could not reach it." Indeed care was always taken to enclose these machines by barriers and wattles, both to prevent the enemy from destroying them and to protect the men that worked them. At the siege of Toulouse, Pierre of Vaux-Cernay relates, that in the combat where Simon de Montfort was slain, "the count and the few men that were with him retired because of a storm of stones and an insupportable cloud of arrows, t that overwhelmed them, stopped before the machines and behind hurdles to shelter themselves, for the enemy cast on our men an enormous quantity of stones by means of two trebuchets, a mangonel and several machines." Then Simon de Montfort was struck by a stone cast by a stone-thrower worked by the women on Place S. Sernin, i.e., at least 640 ft. from the place that the combat occurred. Sometimes the early authors, as in this passage, seem to distinguish the trebuchets from the mangonels. The mangonels certainly were machines with counterpoises like the trebuchets, but the mangonels had a fixed load placed at the end of the beam instead of a movable one, that gave them a particular property.

Note 1.p.232. The importance of the construction of these machines may also be proved by consulting the old accounts of and inventories of fortresses, When in 1428 was destroyed the machine placed on the tower of S. Paul at Orleans, to replace it by cannon, the carpentry of that war machine, that was either a trebuchet or a mangonel, filled 26 wagons, that were driven to the chamber of the city. (Jollois, Histoire du siege d'Orleans. Chap. 1. Paris. 1833.

Villard of Honnecourt calls the machine with counterpoise s suspended by cranks, the counterpoise in the form of a box, a trebuchet; from which one may conclude that if the mangonel is also a machine with counterpoise, this can be only the pendulum machine, such as reproduced in the relief of S. Nicaise of carcassonne,[1] and in many vignettes of manuscripts.[2]

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Note 2.p.233. Latin and old French note.

We have seen that the sling of the trebuchet has its two c

cords attached to the head of the beam, and that the projectil[illegible] produced by the sub-cord. In the representations of machines with beam and balance, one of the cords of the sling is fixed to the end of the beam, and the other is simply passed over a pin, so that when the beam reaches its highest point, this c[illegible] like the ball from a hand sling. This machine, as we shall soon state, possessed properties different from the trebuchet. The trebuchet by its abrupt movement of [illegible] was good for throwing projectiles over high walls or on roofs, just as our mortars throw bombs, but it could not cause the projectile to describe a very elongated parabola approaching the horizontal line. The aim of the mangonel could be regulated much better than that of the trebuchet, because it described a greater circular arc, and it was possible to accelerate its movement.

We shall endeavor to explain this machine.

First (Fig. [illegible]) the beam, instead of passing in the axis of the pivots, was fixed outside this, as indicated by the sketch at A. At its lower end, which was much enlarged (we shall see how and why), were attached weights, ingots of iron or of lead or stones, held by straps and a box of planks B. In its normal position, the beam instead of being vertical as in the trebuchet, must necessarily be inclined toward the enemy, i.e., toward the front of the machine,[1] because of the position of the counterpoise and that of the axle. To lower the beam two winches C were used, fixed to the uprights and corresponding to two guide pulleys D. It is clear that before the enemy, it was not possible to have a man ascend to the top of the beam to fix there the double pulling rope with its pulley and its hook, first because that rope and pulley must be quite heavy, then because a man so exposed to missiles even would have served as an aim for all shooters not occupied [illegible]. We have just seen that these machines were surrounded [illegible] by means of a little winch E attached to the rear of the box of the counterpoise, was moved by two cranks, by the aid of the double rope F passing between two guide pulleys G, the pulley H and its hook, to which was previously conn[illegible] attached the pulley I. The beam being lowered to the [illegible]-

cords attached to the head of the beam, and that the projectile leaves the pouch of this sling from the effect of the shock produced by the sub-cord. In the representations of machines with beam and balance, one of the cords of the sling is fixed at the end of the beam, and the other is simply passed over a pin, so that when the beam reaches its highest point, this c cord of the sling leaves its pin, and the projectile is cast like the ball from a hand sling. This machine, as we shall soon state, possessed properties different from the trebuchet. The trebuchet by its abrupt movement or jerk was good for throwing projectiles over high walls or on roofs, just as our m mortars throw bombs, but it could not cause the projectile to describe a very elongated parabola approaching the horizontal line. The aim of the mangonel could be regulated much better than that of the trebuchet, because it described a greater circular arc, and it was possible to accelerate its movement. We shall endeavor to explain this machine.

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inclination M, the hook of the pulley K was loosed, and the beam described the circular arc M N. The tenders accelerated this movement by pulling on several ropes attached at O and taking the direction O R. If when the beam was loosed the m men pulled strongly on the ropes, and all together, they made the upper end of the beam describe a much greater arc than t that produced by the sole action of the counterpoise, and thus they increased the impulsive force of the projectile S at the moment of its departure. To attach again the pulley K to the pulley H, it was drawn down by means of a rope P and backing the windlass E. The working was sufficiently rapid to make it possible to send 12 projectiles in an hour.

Note 1.p.234. In this elevation we assume one of the side supports to be removed to show the connection of the axle w with the beam.

To facilitate lowering the beam, when the men turned the two great wheels C, the men placed to handle the cords of the counterpoise B pulled on ropes attached at O in the line O V. When the beam was lowered, the men charged with attaching the sling laid the two cords of that sling in the hollow T. One o of these cords remained fixed to the ring X, the other being left likewise on the pin U, the tenders took care to replace the ring of this second cord on the pin, and evidently allowed these two cords to pass above the double cord for pulling the beam, as indicated by the section Z, the two pulleys at a, the end of the beam lowered with its pulley H at n' its pulley K at k, the two pulleys d at d, the two cords of the sling at g g. When the firing cord acted on the little arm e of the hook, the pulley K fell between the two sills, the beam rose and the two cords drew the projectile S. It will be observed here that the projectile S being placed in the pouch of the sling, the two cords of that sliug being of equal length, the one attached to the ring X is loose, while the other fixed to the pin is stretched. The utility of this arrangement will be demonstrated at once. One should again examine the position of the counterpoise, when the beam is lowered; that position is such that the beam must be in equilibrium; that consequently the effort of the tenders to bring it down should be almost nothing, which allows pulling the rope on the pulley K, as indicated by the sketch Z; that this equilibrium obtained by the

principal loads on the axle A, makes effecient the pulling of the men placed at the counterpoise, since at the moment of f firing, there must be a sort of indecision in the movement of the beam; that this pull adds a powerful aid to the weight of the counterpoise, which is necessary for the sling to act properly.

Fig. 14. represents the mangonel from its front side, at t the moment when the beam is lowered. The six men working in the two great windlasses remain within the wheels, so as to unwind the double ropes when the beam has shot the projectile placed in the pouch of the sling. Sixteen men are ready to p pull on the four cords attached to the lower part of the counterpoise. The firer is at his post at A, ready to loose the hook that retains the end of the lowered beam. The master of the machine is at B, he is going to give the signal that causes the simultaneous action of the firer and the pullers; at his call, the beam being no longer held and being pulled by 16 men placed in front, it will rise abruptly and pull the sling, that whistling will describe the great curve and cast the projectile.

Let us now examine how the sling must be attached by only one of its ropes in order to leave at the proper time the pin of the machine, so as to leave the projectile liberty to escape from its pouch.

Here (15) is the end of the beam; one sees at A the fixed attachment consisting of a long clevis swinging on a bolt B; then at C is the iron pin enlarged at its base, and at D is the loop that only slips ower the pin to a certain point, that it cannot pass on account of this enlargement. When the ring is pulled by one of the ropes of the sling (see sketch G), its ring E must fall on the circumference described by the ring F of the loop, a circumference of which the beam is evidently the radius, it is also necessary for the loop to not pass the line I E and be stopped at K by the width of the end of the beam. While the rope of the sling attached to the ring E of the clevis has not passed the line E E′ by the movement imparted, the prolongation of the line I E, the other rope of the sling pulls obliquely on the loop, so that this loop cannot leave the pin C.

That being understood, Fig. 16 indicates the rotary movement

of the beam. The movable rope of the sling will not leave the pin until the projectile has passed the radius of the circle described by the beam, only at the moment when the ropes of the sling form an angle with the beam, as traced in the position A. Then one of the ropes of the sling will continue to pull on the clevis, while the other will loosen, and the centrifugal force impressed on the projectile will cause the loop to leave the pin, as we see at M. The free projectile will d describe its parabola. If the movement of rotation of the beam were equal or progressively accelerated, there would occur a moment when the projectile would be found in the prolongation of the line of the beam (radius), t not leave the line till the moment when the beam stops. But this is not the case, thanks to the arrangement of the axle outside the line of the beam, and the location of the counterpoise outside the axis and the pulling of the men to quicken the movement of rotation at the moment of loosing, a very violent impulse is at first given to the beam, and consequently to the projectile, t the latter under the influence of that primary force describes its curve more rapidly than the beam describes its given arc, since this becomes slower as it approaches its highest point: therefore the cords of the sling must make an angle with the beam as seen at M.

The men placed at the base of the counterpoise regulated t the aim by pulling more or less on the ropes there. If they pulled strongly, the beam described its arc more rapidly and the centrifugal force of the projectile was greater; it sooner passed the prolinged line of the beam; the movable cord of the sling was sooner detached, and the projectile rose higher, b but passed over less distance on the ground. On the contrary, if the men at the counterpoise pulled less on the ropes or n not at all, the projectile was slower in passing the prolongation of the line of the beam; the movable cord of the sling was loosed later, and the projectile only left its pouch when this had passed the vertical, did not rises as high, but passed over a greater distance. Thus the merit of a good master engineer was first, to give the cords of the sling the proper length according to the weight of the projectile, then to regulate the attachment of these two cords, and finally to order more or less pulling on the ropes, according to whether he d

desired to send his projectile higher or farther.

[illegible]

ly managed than the mangonel, but it required less practice, since to regulate the aim it sufficed for a man to know how to attach the sub-cord of the sling. The mangonel must be directed by a skilful engineer, and served by men experienced in the work, unless it would be dangerous for those using it. Indeed, there is sometimes mention of mangonels that would kill their men, a false act, an improper pull on the ropes of the counterpoise, and when it had already made a part of its revolution, it might loose the end of the sling too late and cast the stone on the men placed at the front of the machine.

It would be superfluous to lay more stress on the mechanism of these machines with counterpoises, we have only claimed h ere to give to this study a more practical turn than is the case. It is clear that to know exactly the effects of these formidable war machines, it would be necessary to make them at a large scale and put them to the proof, which would be useless today in view of rifled cannon, we have thought that it was well to make known what our studies brought to the art of killing men, and the attention of the care that they devoted to their building of palaces or churches. These projectiles of machines with counterpoises, that cannot only by night and by day throw projectiles into parts of hostile cities, causing such terrible damage, that it was necessary to come to surrender, were not only the bolts usually shown as in works on the military art of the middle ages. The projectiles were of various kinds; balls of stone, barrels of combustibles, a mass of carrion, burning materials, etc.[1]

Note 1.p.240. See Precis historique de l'influence des armes a feu sur l'art de la guerre, by prince Louis-Napoleon Bonaparte, president of the republic. The illustrious author p proves the importance of the great casting machines of the middle ages, and recognizes their value.

The Orientals appear to have been the first inventors of t these machines with counterpoises, using them with advantage already in the 11 th century. They also employed stone-throwers, Turkish stone-throwers, by means of which they cast on the hostile works not only stones, but also barrels filled w

desired to send his projectile higher or farther.

There was then a notable difference between the trebuchet a and the mangonel. The trebuchet was a machine much less easily managed than the mangonel, but it required less practice, since to regulate the aim it sufficed for a man to know how to attach the sub-cord of the sling. The mangonel must be directed by a skilful engineer, and served by men experienced in the work, unless it would be dangerous for those using it. Indeed, there is sometimes mention of mangonels that would kill their men, a false act, an improper pull on the ropes of the counterpoise, and when it had already made a part of its revolution, it might loose the cord of the sling too late and cast the stone on the men placed at the front of the machine.

It would be superfluous to lay more stress on the mechanism of these machines with counterpoises, we have only claimed h here to give to this study a more practical turn than in the past. It is clear that to know exactly the effects of these formidable war machines, it would be necessary to make them at a large scale and put them to the proof, which would be useless today in view of rifled cannon, we have thought that it was well to make known what our afthers brought to the art of killing men , and the subtlety of the care that they devoted to their building of palaces or churches. These batteries of macnenes with counterpoises, that constantly by night and by day threw projectiles into camps or hostile cities, causing such terrible damages, that it was necessary to come to surrender, were not then the toys usually shown as in works on the military art of the middle ages. The projectiles were of various kinds; balls of stone, bundces of pebbles, a mass of carrion, burning materials, etc.[1]

Note 1.p.240. See Precis hostorique de l'influence des armes a feu sur l'art de la guerre, by prince Louis-Napoleon Bonaparte, president of the republic. The illustrious author p proves the importance of the great casting machines of the middle ages, and recognizes their value.

The orientals appear to have been the first inventors of t these machines with counterpoises, using them with advantage already in the 11 th century. They also employed stone-throwers, Turkish stone-throwers, by means of which they cast on the hostile works not only stones, but also barrels filled w

with inflammable materials (Greek fire), that water could not extinguish, and that adhered while burning to the wooden defensive galleries or planks.

Joinville has left us a streking description of the terreble effects of these machines. "The king and council," says he, " "when it was necessary to pass the branch of the Nile before the Saracens, had a road built across the river to pass toward the Saracens. To protect those working on the road, the king caused to be built two towers, that are called shooting castles (we shall soon treat these machines); for he had two towers before the army and two palisades there to cover those t that watched the shots of the machines of the Saracens, who had 16 machines, 3 all (on the same line and in battery). When we came there, the king had 8 machines made, of which Jocelin of Cornaut was master engireer (a master engineer then d directed the working of several machines). Our machines injured theirs, and theirs ours; but in which I did not hear that ours did much. One evening earlier, when we watched the towers at night, that they had a machine called stone-thrower, that they had also made, and placed Greek fire in the spoon of the machine. The first cast that they made came between our two towers, and struck the place before us that the army had built to pass the river. Our firemen (there were then men particularly charged to extinguish the fires kindled by the enemy) were called to put out the fire; and because the Saracens c could not fire on these firemen on account of the palisaded works connecting the two towers, that the king had caused to be built, they shot straight to the clouds, so that the darts might fall vertically on them. The manner of the Greex fire was such, that it came forward as great as a barrel of verjuice, and the tail of fire from it was as great as a large sword; it made such noise in coming and damage in falling, that it seemed that it was lightning from the sky; it appeared like a dragon flying through the air, such great light was made, that one could see among the army as if it were day, for the great massof fire cast a great light."

These barrels filled with inflammable materials appear to h have been thrown by stone-throwers like that represented in Figs. 7, 8; they had a fuse and contained a mixture of sulphur, oil of naptha, camphor, bitumen or resin, charcoal, dust,

salpetre and perhaps antimony. At that epoch in the middle of the 13 th century, according to Joinville it seems that our casting machines were inferior to those of the Turks, since our always sincere author takes care to state that our machines produced no great effect. Indeed it was only at the end of the 13 th century, that the machines appear to have attained great perfection in France. They were much employed in the wars of the 14 th century and even after the invention of artillery.

The trebuchets and mangonels were placed by the besieged b behind the curtains and on the ground, and they sent their p projectiles against the enemy by passing over the heads of t the crossbow men placed in the galleries. But besides the stone-throwers placed in battery at the level of the galleries on wooden platforms extending these galleries (as we have shown in Art. Architectsre Militaire, Fig. 32), the armies of the middle ages also possessed the tower crossbow, which was a machine, with which were thrown darts of great length, iron bars heated red hot in a fire, arrows wound with tow and Greek fire [1] in the form of rockets. These tower crossbows had the advantage, that they could be aimed like our artillery, which could not be done with the mangonels and trebuchets, as for the latter machines, if it were possible to regulate the aim, this could only be in the same plane, if one desired to cause the projectile to deviate to right or left, it was necessary to move the entire machine, which required a long time. Thus the mangonels and trebuchets were only employed in sieges, either by besiegers to send projectiles against a point of the defenses of the city, or by the besieged to batter the works of approach or the quarters of the enemy. The tower crossbows fired on groups of laborers, on the machines, on serried columns, and they produced the effect of our field-pieces at short range, for their projectiles slew entire files of s soldiers, broke the machines, cut their ropes and passed through the mantlets and palisades.

Note 1.p.244. "We received the Greek fire three times that evening, and they fired the tower crossbow four times." (Joinville. Hist. de S. Louis). "The brothers of the king watched at the tops of the towers (i.e., were on duty at the summits of the towers) to draw from the Saracens the crossbow bolts,

that were cast among the host from the Saracens.

Here (17) is a perspective of the tower crossbow and its details. It is moved by means of three wheels, two of which were fastened to the lower cross-bar A and the third to the movable portion of the carriage. A post C set on an ovoid pin is indicated by the detail C′, holds the carriage on a fixed point serving as a pivot. It was then easy to regulate the fire in the horizontal plane. To raise or lower the aim, i.e., to aim higher or lower, one could first remove the end wheel E, allow the carriage to rest on the two oval follers F and then the aim would take the direction F′G (See outline X). If it were desired to lower the fire a little, the upper part H of the carriage was raised by the double rack K and the two pinions I, to which were attached two cranks. If it was necessary to lower the fire, the wheel E was feft in place, and the upper part of the carriage was raised by means of the racks. The lower part of the carriage was moved on the axle L. The motor consisted of two double steel springs passed through twisted ropes of sinews, seen in our perspective sketches, their ends resting against the two vertical posts of the frame. To stretch these sinew ropes as much as necessary, iron pipes were passed through them, levers were insested in these tubes, at either end, to not allow the ropes to untwist, and the ends of these levers were fastened in the two projections M. If it was felt, that the ropes stretched, these levers were moved a little, refastening them so that the two branches of the bow were always held equally. To bend the bow whose ends were connected by a cord made of hair, sinews or catgut, the two hooks N were placed on that cord; then working the two great cranks O, the cord of the bow was brought by means of the two horizontal racks as far as the double catch P, which to pas the cord was lowered as indicated by the detail R. This trigger was moved by the rod S with its movable ring T at its end, that was passed over a pin, when the catch was raised. Then backing slightly on the racks, the cord stopped on that double catch U, that could not drop into the carriage. The end of the projectile was placed against the end and left free in the groove. And the pointer having arranged everything removed the ring T from the holding pin, and pulled the rod S toward him; the double catch disappeared and the cord returned to its normal

[illegible]

troops if the fire were quite blocking. With a machine of the dimensions given in our Fig. could be shot with full force a spear more than 16 ft. long, a real beam armed with iron, to a great distance, i.e., at least to 164 ft., so as to break machines, palisades, etc. These machines then throwing projectiles directly were those causing the most disorder in troops and particularly in cavalry; thus they were not only used in sieges, but also in the country, at least to protect camps, or to strengthen an important post.

There was also employed a machine with a spring, whose force was less, but more simply constructed, and it could be made in the country with the wood that could be procured, without its being necessary to use racks and all that ironwork, which required time and special workmen to make them. This machine is very ancient and recalls the catapult of the Romans of antiquity. It consists (13) of a vertical cylindrical axis with a flat front (see plan A) turning on two pins. At the base of this axis is fixed a triangular frame placed on two wheels and connected with the said axis by two ties or struts. Wooden springs are strongly fastened to the foot of the axis with iron straps and strong cords. A windlass fixed on two verticals is moved by cranks and pulleys. One end of a cord is fastened to the upper end of that spring, and another end with hook to the projecting arm is coiled on the windlass after having passed over a directing pulley. Four men bent the spring. A spear passed through a hole made in the upper end of the axis D, and a movable forked support E supported by the rack F, permitted raising or lowering the fire, as shown by the sketch G. [illegible] moved the lower frame on its bed according to the direction of the fire, and pulling the cord C loosed the hook: the spring struck the spear at its end and sent it far in the direction given to it. Fig. 13 gives the plan of the machine.

Artillery was employed when yet for a long time were used these machines with counterpoises for battering, and these tower crossbows, had trusted so much to their power, even if the first cannons did not attempt to produce other effects. The stone-throwers, crossbows and mangonels threw in full f

place while projecting the dart. (See plan Y). A slight pressure on the dart by a spring prevented it from slipping in its groove if the fire were quite plunging. With a machine of the dimensions given in our Fig. could be shot with full force a spear more than 16 ft. long, a real beam armed with iron, to a great distance, i.e., at least to 164 ft., so as to break machines, palisades, etc. These machines then throwing projectiles directly were those causing the most disorder in troops and particularly in cavalry; thus they were not only used in sieges, but also in the country, at least to protect camps, or to strengthen an important post.

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Artillery was employed when yet for a long time were used these machines with counterpoises for battering, and these t tower crossbows, man trusted so much to their power. even if the first cannons did not attempt to produce other effects. The stone-throwers, trebuchets and mangonels threw in full f

fired great balls of stone, that weighed up to 200 or 300 lbs.; [illegible] cast projectiles with full weight, they were [illegible] and these guns sending balls point blank, after the 14 th [illegible] they were only small pieces throwing projectiles of the size of a pigeon egg.

Moving Batteries a war. Offensive Artillery.

From the day when was recognized the force of the gases produced instantaneously by gunpowder, men had the idea of utilize that force to send afar solid projectiles, balls of stone or cases of debris. A great advantage was found in replacing the enormous and expensive machines, some examples of which we have just described, by iron tubes more easily transported, costing less to establish, and that the enemy could scarcely injure. We have nowhere seen that the military nobility occupied itself in perfecting the machines or in directing their construction. All names of engineers are names of plebeians. If Philip Augustus, Richard Lionheart and some other warlike sovereigns appear to have attained importance in the manufacture of the machines, they always had recourse to master engineers, that seem to have sprung from the people. This disdain of combinations requiring mathematical labor and the knowledge of several trades, such as carpentry, ironwork and mechanics, the nobility at first applied to the primary study of artillery; it did not seem to take account of this formidable application of explosive power, and left to tradesmen the care of seeking the first elements of the art of the artillerist.

In 1356 the Black prince besieged the castle of Romorantin; among other casting machines, he employed cannon for throwing stones, bricks, buckets filled with Greek fire. These first guns were long, thin, made of iron staves, of cast iron or of copper, reinforced at certain distances by iron rings, and transported on the backs of mules or on wagons. These guns were then called "scorpions, serpes or scorpions", and later "veuglaires", and consisted of a tube open at each end. To one end was fitted a case containing the charge of powder and the projectile, i.e. the gun was loaded at the breech; but this breech was completely independent of the tube and was fastened to it by a movable band, as indicated in Fig. 20. As

flight great balls of stone, that weighed up to 200 or 300 lbs,; these could not cast projectiles with full scope. They were replaced by mortars with which the same results were obtained; and these guns sending balls point blank, after the 14 th century were only small pieces throwing projectiles of the size of a grapeshot.

ENGINS OFFENSIFS A FEU. Offensive Artillery.

From the day when was recognized the force of the gases produced instantaneously by gunpowder, men had the idea of utilizing that force to send afar solid projectiles, balls of stone or cases of pebbles. A great advantage was found in replacing the enormous and expensive machines, some examples of which we have just described, by iron tubes more easily transported, costing less to establish, and that the enemy could scarcely injure. We have nowhere seen that the military nobility occupied itself in perfecting war machines or in directing their construction. All names of engineers are names of plebeians. If Philip August, Richard Lionheart and some other warlike s sovereigns appear to have attained importance in the manufacture of the machines, they always had recourse to master engineers, that seem to have sprung from the people. This disdain of combinations requiring mathematical labor and the knowledge of several trades, such as carpentry, ironwork and mechanics, the nobility at first applied to the primary study of artillery; it did not seem to take account of this formidable application of explosive powder, and left to tradesmen the care of seeking the first elements of the art of the artillerist.

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At A is seen the case of the gun cut lengthwise, at B is the cross section at a b; at C is the case joined to the piece by means of the band, that stops on the projections d d′ of the serrate ring; at D is the same case shown laterally with the band e fitted with its handle for lifting it and removing the case when the piece has been fired. The top points g on each of the serrate rings served for aiming. We do not know much of how these guns were pointed; they were probably suspended from trestles by the rings with which they were furnished. T The movable cases fitted to one end of the tube allowed the escape of a considerable part of the gas, and this must frequently cause accidents, hence were renounced the fitted cases, to make guns cast in a single piece, loaded at the muzzle. S Some years since were found in the church of Ruffec two guns, that appeared to belong to the 14 th century; these are tubes of cast iron without cases, closed at the breech and suspended by rings.

We give (21) these two pieces, which are of small dimensions; at A we have sketched a fragment of a cannon, that seems to us to belong to the same epoch, which was found in excavations at Boulogne-sur-Mer.

In 1380 the Venetians employed cannon in the war against t the Genoese; "ribaudequins." (Small guns on wheels).

Those first pieces of artillery were replaced by mortars a and cannon.

After 1412 the use of mortars and guns caused the disappearance of offensive machines for the defense of places. "It results," says Jollois in his Histoire du siege d'Orleans (1428) "from a statement made with care by the late abbe Dubois, that in 1428 and 1429 the city of Orleans possessed 71 cannon, both guns and mortars, all of copper. In the number of these p pieces are comprised the gun lent to the city of Orleans by the city of Montargis, a great cannon named Riffard,[1] a mortar made by one named William Duisy, a very skilful workman, according to the journal of the siege, that threw stone balls weighing 120 lbs., and so enormous that it required 22 horses[2] to haul it with its carriage from the harbor to the city hall. These two cannon and this enormous mortar were placed in battery on the tower of the cross of Meuffray, located between t the bridge and the postern Chesneau, from which the battered the fort of Tournelles in the possession of the English.

Among the guns just indicated must be counted a cannon [3] that threw stone balls as far as the island of Charlemagne. It was only under the reign of Louis XI that iron balls were substituted for stone balls." Yet the latter were still used at the end of the 15 th century.

Note 1.p.249. See Journal of the siege, p.21. It was customary to give names to the machines during the middle ages, just as in our days to portholes in the marine. Until the 16 th century each gun had its name, perhaps they had sponsors like bells.

Note 2.p.249. This fact is the result of the expense included in the accounts of the fortresses for payment of this transportation.

Note 3.p.249. "One sees in the accounts of the fortresses of the city of Orleans, that a skilful artizan named Naudin-Bouchart cast during the siege a very beautiful and very long gun for throwing balls from above the bridge into the island of Charlemagne, against the English who crossed the Loire to pass from this island to the field of S. Pryve, where they had a fortress." From the old bridge to the middle of the island of Charlemagne is 3810 ft.; mortars and cannon then could not carry to such a great distance, the cannon of Naudin-Bouchart was an innovation.

Although the names of cannon and mortars may have been given indifferently to guns that threw stone balls, yet the name of mortar appears to have been given by preference to a short gun of very great diameter, throwing projectiles with full flight, while the cannon of less diameter and longer could send balls point blank.

These mortars are sometimes designated by the name of basilisks. At the siege of Constantinople in 1413, Mahomet II placed in battery mortars with stone balls of 200 lbs. These guns were cast by a Hungarian. One of these mortars was even intended to throw a ball of 850 lbs.; 2000 men must serve it, and 10 pairs of oxen haul it, but it burst at the first test and killed a great number of men. In 1460 James II of Scotland had a monster mortar cast, that exploded at the first shot.

About that epoch were renounced hooped guns, but cannon and mortars were made with inserted cases, principally for pieces of not very great diameter; since for mortars that threw balls

of 60 lbs. or more, they were made of cast iron or copper, or even of wrought iron in the form of a tube with a single opening. There exist some mortars made in the middle ages of flat iron staves encircled by iron hoops like casks; perhaps these guns are the oldest; they were not loaded by means of powder cases, but like our modern guns, except that the powder was introduced by means of a spoon, then the wad and the ball, lastly a wad of hay or rags, by the aid of the rammer.

The first cannon known to us and so fabricated is found in the arsenal of Basle (Switzerland; 22). It is of wrought iron. The breech A is forged in a single piece; the body consists of staves of flat iron 1.18 ins. thick by 2.36 ins. wide. These staves are united by a series of iron rings of greater or lesses thickness, at B is a much thicker ring beneath which is placed a band of copper. At C is represented the mouth of the gun, whose bore is not less than 13.0 ins. diameter. The touchhole is very small. In the same arsenal is seen another gun of copper 6.6 ft. long; it dates from 1444 and bears the shield with the arms of Burgundy. During the 15 th century w were made guns of very variable dimensions, from the falconet that carried a ball of one lb. to the mortar that threw stone projectiles of 200 lbs. or more.[1] These mortars were seldom long in proportion to their diameter and fulfilled nearly the function of mostars sending the projectile in full flight; th- they were loaded at the muzzle. Hollow projectiles were also employed, that were filled with explosive materials or Greek fire, and it is an error to suppose that bombs are the invention of the last years of the 16 th century, for several treatises of the end of the 15 th and beginning of the 16 th centuries show actual bombs made of two hemispheres of wrought i iron connected by cords or bands (23). At the end of the 15 th century, cannon are classified by nature, according to the diameter of the projectiles; there are basilisks, which are the largest, mortars, ribaudequins, cannons, flying dragons, scorpions, culverines, stone-throwers, sirens, "passe-mur," "passe-avant," serpentines. Under Charles VII the royal army already possessed numerous artillery, and Charles VIII in 1494 entered Italy, taking more than 140 bronze cannon mounted on wheeled carriages, drawn by teams of horses, and well served.[3] The Italians then possessed only iron guns hauled by

oxen, so badly served that they could scarcely fire one shot in an hour.

Note 1.p.251. There still exist in mony old cities, ond notobly ot Amiens, stone bolls, "bedoinee," thot hove up to 23.6 ins. diometer, ond which weigh up to 276 lbs.ond more. These bolls ore perfectly sphericol, cut with core in hord sondstone.

Note 2.p.251. See Robert Volthurius, De re militori, pl. of 1483, Poris edition, 1535. p. 116. Poris. printed by Christion Wechel.

Note 3.p.251. Guichordin, Commines, Poul Jove.

The idea of loading cannons at the breech was that first p presented, as this will probably be the last improvement made in the fabrication of cannon. Men must reject the first cases that fitted badly, allowed the gas to escape, sometimes sent a large portion of the load at the men, and were quickly put out of order by the effect of the recoil. Men contented themselves with making at the breech of the gun a recess allowing the introduction of an iron or copper case containing the charge of powder kept in place by a disk of wood. This case was fixed in several ways; it was fitted with a handle to aid in placing it and removing it after firing. The ball was slipped into the bore of the gun before introducing the case, and was rammed down with a wad of hay or turf after this introduction. Each cannon had several cases loaded with powder beforehand, so as not to delay firing.[1] Each case was pierced by a touchhole that was fitted with a tube filled with powder, that the firer inflamed by means of an iron rod heated redhot in a furnace. This method had some advantages: it avoided heating the gun and the accidents resulting therefrom; it permitted the preparation of the loads in advance, for these cases were merely cartridges inserted in the breech, like the cartridges of Lefaucheux guns, except that the ball must be inserted before the case and be rammed down afterwards. It had inconveniences, that are easily recognized, a considerable part of the gas must escape at the junction of the case with the bore, and consequently the force of the explosion was partly lost; it was necessary to clean frequently the bottom of the chamber and the groove to remove the dirt, that opposed the perfect junction of the case aud of the gun; the point of junction was worn after a certain number of shots, and then nearly the

entire charge escaped without action on the ball.

Note 1.p.252. The name of case given to bombs fired at festivals comes from this. Then at public rejoicings instead of loading pieces of artillery, as at present, with blank cartridges, men were contented to load the cases of cannon, tamping the powder with wooden tamps driven by strokes of a mallet. At the beginning of the (19 th) century were still found in most old cities old cases reserved for this use.

We give (24) drawings of these cannon with inserted cases. At A is a gun with jaws for th insertion, the transverse section through the case is indicated at B; the case C with its handle D and touchhole E is in its intended place; two keys G pass through two holes in the jaws and press the case against the bottom of the opening. At H we give the longitudinal section of the case ready for firing; by means of the key K, the opening of the case has been forced into the groove I made at the entrance of the bore; the two horizontal keys G have been driven by strokes of a mallet; the case is full of powder held by the plug T; the ball is rammed down. At M is seen the empty case with its plug and tube O for the touchhole. At P we have represented another system of insertion without jaws, i into which the case was also forced into the groove by a key, and it was held by means of a single longitudinal bar hinged on the bolt N; a single key R passing through the two ends of a band of wrought iron, held that longitudinal bar.

In the last case the touchhole of the case was at one side. It is necessary to believe that the inconveniences inherent in this system caused it to be abandoned very quickly, for t the use of these guns with inserted cases was soon rejected to further employ only tubes of cast iron or copper with a single opening. Besides if one saved time by loading several cases in advance, they lost much in removing the keys and replacing them, without counting that the holes for the keys q quickly became worn, were enlarged, and no longer allowed the cases to be properly held,and it was then necessary to change the keys and to use thicker ones. Some of these guns are still seen in our arsenals and at the museum of artillery at Paris; some are of wrought iron, but the largest are of cast iron.

The first cannon were mounted on carriages without wheels, and simply set on wood, or carpentered as then said, i.e., pl

[illegible]

obtained by raising this wooden trough at front or rear by means of crowbars and wooden wedges (25). They also mount a mortar to point it. Du Clercq in relating the death of Jacques de Lalain, says that "the marshal of Burgundy, lord Antoine, bastard of Burgundy, lord Jacques de Lalaing, (at the siege of the castle of Poucques) went to mount a mortar to batter the said castle; and as they seated the said mortar, those of the castle fired a little cannon at the said lords, with which they hit J. de Lalaing and carried off the helmet from his head." From affûter (to mount) comes the word affût (carriage), that from the 16th century was employed to designate [illegible] in carpentry and bound.

The vignettes of manuscripts of the middle of the 15th century give us a great variety of these primitive troughs.[1] Under Charles VII and Louis XI however, the field artillery made rapid progress; already at that epoch it possessed carriages arranged for firing, allowing the guns to be pointed quite rapidly; but they were far from having conceived the movable advanced train, and when cannon were transported, it was necessary to place them on special [illegible] separate from the carriages. During a battle the artillery could not be moved, except some small cannon, as done 250 years since. The artillerists mistrusted their guns so much (and certainly with good reason), that they sought to secure themselves against the very frequent accidents that occurred in firing. Not satisfied by enclosing the cannon in heavy carpentry, and hooping them strongly to prevent their bursting or to lessen its effect, they often fixed their cannon and mortars in boxes composed of heavy timbers strongly bound together. These troughs formed a guard around the piece, which protected the men in case of accident. At the moment of firing everyone escaped, and the man charged with firing by the aid of a long rod made red at the end, placed himself beside the trough.

Note 1.p.254. Art. Architecture Militaire, Figs 42 to 43 bis.

Here is one of those trough carriages (25). The gun was inclined so as to throw the projectile in full flight; its muzzle was enclosed in the front end of the trough and its bree-

placed in a trough made of great timbers and fastened together by bolts, iron bands or merely ropes. The pointing was only obtained by raising this wooden trough at front or rear by m means of crowbars and wooden wedges (25). They said mount a mortar to point it. Du Clercq in relating the death of Jacques de Lalain, says that "the marshal of Burgundy, lord Antoine, bastard of Burgundy, lord Jacques de Lallaing, (at the siege of the castle of Foucques) went to mount a mortar to batter the said castle; and as they seated the said mortar, those of the castle fired a little cannon at the said lords, with which gun they hit J. de Lallaing and carried off the helmet from his head." From affuter (to mount) comes the word affut (carriage, that from the 16 th century was employed to designate the carpentry supporting the cannon, permitting it to be placed in battery and pointed.

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Note 1.p.254. Art. Architecture Militoire, Figs 42 to 43 bis.

Here is one of those trough carriages (26). The gun was inclined so as to throw the projectile in full flight; its muzzle was enclosed in the fronm end of the trough and its bree-

breech rested on the bottom. At A is seen the cross section of the piece and its trough, and the arrangement of the ropes that fixed it. The recoil of the gun was prevented by stakes B driven in the ground. At C is placed the furnace for heating the rods for firing. The charge of powder was inserted by means of a great wrought iron spoon. One imagines that such an engine could be moved but mounted but once, i.e., placed in position to send projectiles to one point, thus these guns were employed only in sieges and not used in the field. If t the artillerists claimed to protect themselves from the explosion of a defective gun, they also thought of sheltering themselves from the hostile projectiles. For that purpose thick mantlets of wood were placed before the cannon. These mantlets swung on a horizontal axis, were raised at the moment of firing, and became vertical by their own weight when the piece was discharged, so as to thus shelter entirely the men occupied in loading it. (27).[1] Then were also made triangular carriages, more easily handled than the preceding, allowing the pointing within a certain arc of a circle. These triangular carriages were fixed at the apex of the triangle by means of a pivot, and were swung by the aid of two wheels fixed at the ends of the cross-piece. But men renounced those mortars of e enormous dimensions only suitable for throwing stone balls, iron balls were adopted, considerably less powder was burned, and the cannon no longer attained those colossal proportions, that rendered transportation difficult.

Note 1.p.256. At the siege of the castle of Poucoues in 1453, when Jacques de Lalain was killed, he and other lords "went to see the artillery and a mortar named the Bergere (shepherdess), that fired frequently; and they kept themselves covered by the mantlet of that mortar." Mem. d'Olivier de la Marche, Chap. 27. "And they (men of Ghent) had banners, wagons, mantlets, culverins and artillery (battle of Berselle)." Chron. de J. D. Lalain. "And they (men of Ghent) went right before the city of Hulst, taking a great number of wagons, artillery, b both cannon, culverins, mantlets and other things,belonging to the said artillery. (Siege of Hulst)." The same.

At the end of the 15 th century and the beginning of the 16 th were cast bronze guns of remarkable dimensions and beauty. There exists in the arsenal at Basle one of those great guns

14.8 ft. long, covered by ornaments and ending in a dragon's head; it was cast at Strasburg in 1514.

Fleurange in his Memoirs, chapter VII, says that in 1509 t the Venetians, at the battle of Aignadel by the French, possessed "60 good pieces, among which were some longer than long culverins, which are called basilisks, and fired balls, all h had a lion on top, or had inscribed around the said lion,"Marco."

At that epoch were already employed mortars suited to the great stone balls or cases filled with inflammable materials. A painting by Feselen (Melchior), deceased in 1538, and now forming a part of the collection deposited in the Pinacothek of Munich (No. 35), representing the siege of Alesia by Julius Cesar, shows us a great mortar mounted on a carriage, in which the artillerist places a spherical projectile (28). The two wheels are taken off and lie beside the carriage. Thus t the mortar seems to rest on the ground, and the proper inclination was given to it by the aid of levers and wedges slipped under the breech. At the end of the 15 th centurw and from the time of Louis XI were used iron projectiles heated redhot in a fire. Georges Chastelain [1] states that at the siege of A Audenarde the men of Ghent "with their mortars, cannon and b breech-loaders, battered the said city, and among others threw several redhot iron balls of the size of a silver cup, and set the city on fire.

Note 1.p.258. Chron. de J. D. Lalain.

But let us return to our carriages. To make pointing the p pieces possible, either vertically or horizontally, were first placed two wheels at the front end of the carriage, and this was divided in two superposed parts, the upper one able to d describe a certain arc of a circle (29). The cannon was kept in place on the joined timbers, pivoted on a horizontal bolt placed under the muzzle. The very long train of these timbers formed a lever, and was elevated more or less high by means of iron rods passed through the double racks B. Thus the train could be raised ts A'. The lower part of the carriage rested on the ground and had two iron points intended to prevent the effects of the recoil. At E is reproduced the rear end of the carriage with its two points and the two superposed members. Yet the upper member receiving the cannon, however long the train, much effort was necessary to raise that mass, which

[illegible]

breech; after each shot it was necessary to lower that upper member of the carriage to the lower member, load the gun, then point it anew by elevating the train to the desired point. We sought to make this work easier. Instead of moving the entire upper member on an axis placed under the muzzle of the piece, the lower part of the carriage was made movable, and instead of placing the bolt at the muzzle, it was put under the breech: ([illegible]); the effort of raising the gun was thus made much less, because its weight was always transferred to the axle, and the more the train of the carriage was elevated, the less the weight of the cannon acting on the member. These different systems were abandoned about 15[illegible]; when to the two wheels was added the third of the train, this caused the separation of it into [illegible] members, between which was placed that third wheel. The piece was pointed no longer by elevating the carriage, but by wedges or screws under the breech of the gun, held on the carriage by means of trunnions, for one will observe that until about the middle of the 16th century cannon had neither trunnions nor handles, and that they were held in the longitudinal groove of the carriage only by iron straps or even ropes.

At the end of the 16th century bronze cannon were divided into regular and bastard; the regular presented the following varieties: the dragon or double culverin throwing an iron ball of 40 lbs. and reaching 1534 paces at 2.5 [illegible], each point blank; the regular or ordinary culverin throwing an iron ball of [illegible] lbs to 1[illegible] paces; the half culverin throwing an iron ball of 1[illegible] lbs. to [illegible] paces; the saker or quarter culverin throwing a ball of 5 lbs. to [illegible] paces; the falconet or eighth culverin throwing an iron ball of 2.5 lbs. to 565 paces; the [illegible] throwing an iron ball of 1.25 lbs. to 411 paces, the smeriglion throwing 15 oz. of lead to 415 paces. The bastard pieces comprise the flying dragon or double culverin throwing an iron ball of 32 lbs. to 1275 paces point blank; the basse-[illegible] throwing a 15 lb. ball 1120 paces; the basse-eight throwing an 8 lb. ball [illegible] paces; the extraordinary saker throwing a 4 lb. ball [illegible] paces; the extraordinary falconet throwing a 2 lb. ball 4[illegible] paces; the passe[illegible] a 1 lb. ball 2[illegible]4 paces;

made pointing very slow. Besides, to force back to the powder charge the enormous stone balls then placed in the mortars, it was necessary to incline the gun from the muzzle toward the breech; after each shot it was necessa y to lower that upper member of the carriage to the lower member, load the gun, then point it anew by elevating the train to the desired point. Men sought to make this work easier. Instead of moving the entire upper member on an axis placed under the muzzle of the piece, the lower part of the carriage was made movable, and instead of placing the bolt at the muzzle, it was put under the breech; (30); the effort of raising the gun was thus made much less, because its weight was always transferred to the axle, and the more the train of the carriage was elevated, the less the weight of the cannon acting on the member. These different systems were abandoned about 1530; then to the two wheels was added the third on the train, this caused the separation of it into heavy timbers, between which was placed that third wheel. The piece was pointed no longer by elevating the carriage, but by wedges or screws under the breech of the gun, held on the carriage by means of trunnions, for one will observe that until about the middle of the 16 th century cannon had neither t trunnions nor handles, and that they were hild in the longitudinal groove of the carriage only by iron straps or even ropes.

At the end of the 16 th century bronze cannon were divided into regular and bastard; the regular presented the following varieties; the dragon or double culverin throwing an iron ball of 40 lbs. and reaching 1364 paces of 2.5 ft. each point blank; the regular or ordinary culverin throwing an iron ball of 20 lbs to 1200 paces; the half culverin throwing an iron ball of 10 lbs. to 900 paces; the saker or quarter culverin throwing a ball of 5 lbs. to 700 paces; the falconet or eighth culverin throwing an iron ball of 2.5 lbs. to 568 paces; the ribaudequin throwing an iron ball of 1.25 lbs. to 411 paces, the emerillon throwing 15 oz. of lead to 315 paces. The bastard pieces comprise the flying dragon or double culverin throwing an iron ball of 32 lbs. to 1276 paces point blank; the passe-mur throwing a 16 lb. ball 1120 paces; the passe-volant throwing an 8 lb. ball 840 paces; the extraordinary saker throwing a 4 lb ball 633 paces; the extraordinary falconet throwing a 2 lb. b ball 498 paces; the passager sending a 1 lb. ball 384 paces;

emerillon sending a half lb. ball 294 paces. There were also cannon, that comprised:- the ordinary cannon or batter-wall sending a 48 lb. ball 1600 paces point blank; the hal cannon throwing a 16 lb. ball 850 paces; the quarter cannon called persecutor throwing a 12 lb. ball 640 paces, do. There were also some bastard cannon somewhat larger than the ordinary guns, rebuffes, crepans and verrats, the crepans being half cannon and the verrats quarter cannon.

We do not think it necessary to speak here of the singular inventions to which artillesists had recourse at the end of the 15 th century and beginning of the 16 th, inventions that could only cause terrible accidents and make victims of those employing them, such as the bent guns, radiating guns with a single charge at the centre, the guns with several barrels, etc.

ENGINS OFFENSIFS ET DEFENSIFS. Offensive and Defensive Machines.

We first class in that series of machines the covered battering rams, that were in use among the Greeks and Romans of antiquity, as well as among the Byzantines, and that only ceased to be employed at the beginning of the 16 th century, a also the cats, vines and towers. The ram consisted of a long beam armed with an iron head at its front end, suspended in horizontal equilibrium by ropes or chains, and moved by men by means of ropes fastened to its rear end. By moving this timber back and forth, the surface of the wall was battered, so that it was dislocated and broken in pieces. The men were sheltered beneath a roof covered by green hides, by manure or turf, both to stop the shock of projectiles and to prevent the effect of burning materials cast by the besieged. The entire machine w was placed on rollers or wheels, so as to approach the walls by means of capstans or levers. The besieged sought to break the ram by means of timbers dropped on its head at the moent when it struck the wall; or indeed they siezed that head by the aid of double iron jaws called loup or louve.(Wolf).[1] The ram attacked the gates and they were broken.soon. At the siege of Chateauroux, after Philip August had invested the city, he sent miners to the foot of the ramparts, destroyed the merlons by means of stone-throwers, brought the battering ram before the gate "all plated with iron," caused the movable towers to advance opposite the defenses of the enemy, covered the para-

garrisons with a hail of bolts, arrows and balls from slings.[1] [illegible] persed; breaches were very soon opened by means of that powerful engine in the thick walls, unless the besieged succeeded in neutralizing their repeated strokes; so the besiegers gave all their care to protect this movable beam, as well as the men moving it. To offer the least opportunity possible to the projectiles of the besieged, the covering of the ram was much inclined; they made a sort of large and steep gable roof with a hip on the rear end, the whole covered by very strong timbers reinforced by iron bands, and as stated above, covered by [illegible] ered with turf or manure.

Note 1.p.26. Old French Note.

Note 1.p.263. Villon le Breton. Philippide. Chant 2.

Fig. 21 shows the woodwork of that machine, omitting the covering timbers and purlins. The ram A, a beam at least 32 ft. long, was suspended by two parallel chains attached to the lower ridge-piece, so as to be in perfect equilibrium. To move this beam and produce a powerful shock ropes were fastened to it at C at about one-third its length; they permitted 8, 10 or 12 men to place themselves at right and left of the machine; these men were very regularly placed and worked thus; the foot D remained in the same place, the right foot for the men on the right, the left one for those on the left. The first movement was thus represented at E; with the beam in its normal position, it consisted in pulling it backward, and after several efforts, the beam reached the level A'F'. Then the second movement of the men was that at F. The beam then passed over the entire space. The third movement is indicated at G. The head H of the ram striking the wall as an obstacle, the men continued with the first two movements, E and F. It is understood that a movement F G made by a beam 32 ft. long must produce a terrible effect at the base of the wall. The head [illegible] form of the head of a ram. (See detail 9).

[illegible][1] [illegible] by [illegible], that were moved forward on rollers to the foot of the wall, permitting miners to undermine the masonry at its base. We have represented one of these machines in [illegible]. Mili-

parapets with a hail of bolts, arrows and balls from slings.[1] The effect of the ram was disastrous for the ramparts not t terraced; breaches were very soon opened by means of that powerful engine in the thick walls, unless the besieged succeeded in neutralizing their repeated strokes; so the besiegers gave all their care to protect this movable beam, as well as the men moving it. To offer the least opportunity possible to the projectiles of the besieged, the covering of the ram was much inclined; they made a sort of large and steep gable roof with a hip on the rear end, the whole covered by very strong timbers reinforced by iron bands, and as stated above, covered by fresh hides of horses and cattle, covered by tamped rich earth with turf or manure.

Note 1.p.260. Old French Note.

Note 1.p.261. Willion le Breton. Philippide. Chant 2.

Fig. 31 shows the woodwork of that machine, omitting the c covering timbers and purlins. The ram A, a beam at least 33 ft. long, was suspended by two parallel chains attached to t the lower ridge-piece, so as to be in perfect equilibrium. To move this beam and produce a powerful shock ropes were fastened to it at C at about one-third its length; they permitted 8, 10 or 12 men to place themselves at right and left of the machine, these men were very regularly placed and worked thus; one foot D remained in the same place, the right foot for the men on the right, the left one for those on the left. The first movement was that represented at E; with the beam in its normal position, it consisted in pulling it backward, and after several efforts, the beam reached the level A'H'. Then the second movement of the men was that at F. The beam then passed over the entire space. The third movement is indicated at G. The head H of the ram striking the wall as an obstacle, the men continued with the first two movements, E and F. It is understood that a movement K L made by a beam 33 ft. long must produce a terreble effect at the base of the wall. The head of the beam was armed with a mass of iron having nearly the f form of the head of a ram. (See detail P).

Cats and vines [1] were nothing more than wooden sheds covered by fresh hides, that were moved forward on rollers to the foot of the wall, permitting miners to undermine the masonry at its base. We have represented one of these machines in Art. Mili-

[illegible]

these were built before the ... ramparts took the place of cats in their lower part; so in that case they were termed cat-castles. This enormous machine was employed by the Romans, and Caesar speaks of it in his Commentaries. Men did not fail [illegible] ages. Suger relates in his Histoire de la vie de Louis le Gros, that this prince besieging the castle of Gournay, after a fruitless assault, caused to be erected a tower of three stories, of a prodigious height, a machine that exceeded the defenses of the castle and prevented the slingers and archers from appearing at the battlements. To the colossal machine was fastened a wooden bridge rising above the ramparts of the place, and when lowered it could aid the besiegers to take the upper galleries. In the poem of the 12 th century of Oger l'Ardennois, Charles besieging the castle in which Oger is enclosed, commanded the engineer Malrin, who only occupied 15 days in taking the strongest place. That engineer employed 140 carpenters in making a tower [illegible]

[illegible]

Note 2.p.262. Verse 5724 et seq.

As a cost the author may be suspected of some exaggeration in causing 1170 men to enter his tower; but he does not claim that it was movable. Further on he says:- (Old French poem).[1]

Note 1.p.264. Verse 6187 et seq.

One also reads in the Roman de Brut this passage:

"The tower began to approach the wall,"
"And the defenders to take success."[2]

Note 2.p.274. Verse 526.

And in the continuator of Villehardouin:- (Old French text).

Examples abound. These movable towers, cat-castles, were often made of green timbers cut in the forests near the besieged place,[2] which made their destruction by fire more difficult. They were usually placed on four wheels and moved by means of capstans placed inside the interior itself of the machine, in the ground story. By means of anchors or stakes and ropes these heavy machines were to advance just like a ship by its anchors. The ground was leveled and covered by timbers up to the edge of the ditch. This was filled with a slight slope

Militaire, Fig. 15. Cats also served to protect the laborers that filled the ditches. Frequently the movable wooden towers that were built before the besieged ramparts took the place of cats in their lower part; so in that case they were termed cat-castles. This enormous machine was employed by the Romans, and Cesar speaks of it in his Commentaries. Men did not fail to make frequent use of it during the sieges of the middle a ages. Suger relates in his Histoire de la vie de Louis le Gros, that this prince besieging the castle of Gournay, after a fruitless assault, caused to be erected a tower of three stories, of a prodigious height, a machine that exceeded the defenses of the castle and prevented the slingers and archers from appearing at the battlements. To the colossal machine was fastened a wooden bridge rising above the ramparts of the place, and when lowered it could aid the besiegers to take the upper galleries. In the poem of the 12 th century of Ogier l'Ardenois, Charles besieging the castle in which Ogier is enclosed, commanded the engineer Malrin, who only occupied 15 days in taking the strongest place. That engineer employed 380 carpenters in building a tower for the assault.(Old French poem) [2]

Note 1.p.263. Old French Note.

Note 2.p.263. Verse 6734 et seq.

As a poet the author may be suspected of some exaggeration in causing 1170 men to enter his tower; but he does not claim that it was movable. Further on he says:- (Old French poem).[1]

Note 1.p.264. Verse 8137 et seq.

One also reads in the Roman de Brut this passage.

"The tower began to approach the wall,"

And the trebuchets to cast stones." [2]

Note 2.p.264. Verse 323.

And in the continuator of Villehardouin:- (Old French text).

Examples abound. These movable towers, cat-castles, were o often made of green timbers cut in the forests near the besieged place,[3] which made their destruction by fire more difficult. They were usually placed on four wheels and moved by means of capstans placed inside the interior itself of the machine, in the ground story. By means of anchors or stakes and ropes these heavy machines were to advance just like a ship by its anchors. The ground was leveled and covered by timbers up to the edge of the ditch. That was filled with a slight slope

from the counterscarp to the foot of the wall. The filling of the ditch was likewise covered by timbers, when the tower was brought to the crest of the counterscarp, then allowed to roll by its own weight, guiding it by guys, until against the rampart attacked. The talent of the engineer consisted in well calculating the height of the wall, so that at the proper moment the bridge was dropped on the battlements. A figure is necessary to make us understand. Let (32) a wall A be required to be forced. First of all by means of projectiles thrown by trebuchets and mangonels, the besiegers have destroyed or made useless the defensive galleries B, have filled the ditch D, and have covered the filling by a good inclined floor. The tower is brought to the point C, started on the floor and rolls down by itself; the projections E of the calculated length butt against the foot of the wall. Their braces G are covered by strong timbers, forming a hut suitable to protect pioneers and miners if necessary. Then the bridge H is dropped suddenly: it falls on the top of the parapet, breaks the coverings of the defensive gallery, and the assaulting forces throw themselves into the upper gallery K. During this time, archers and crossbowmen posted at I on the last story cover these upper galleries with projectiles, so that they confine and disconcert the defenders, who at right and left oppose the torrent of assailant soldiers. Besides the internal ladders, at the moment of assault, numerous other ladders were placed against the rear wall of the tower, left nearly open. We have omitted in this figure the timbers and fresh hides that covered the carpentry, in order to permit the latter to be seen; but we have given in Art. Architecture Militaire, Fig. 15, one of these enclosed towers at the moment of assault. About the middle of the 15th century, small cannon were placed on the tops of these towers and on the lower floors to batter the foot of the walls and to cover the upper gallery with grenades.[1]

[1] [illegible] of 1465.

Among machines suitable for making the assault should not be neglected the ladders frequently employed and often arranged in ingenious fashion. Galbert in his Vie de Charles le Bon speaks of a certain ladder made to scale the walls of the castle of Bruges, that was very wide, protected by high palisades

from the counterscarp to the foot of the wall. The filling of the ditch was likewise covered by timbers, when the tower was brought to the crest of the counterscarp, then allowed to roll by its own weight, staying it by guys, until against the rampart attacked. The talent of the engineer consisted in well calculating the height of the wall, so that at the proper moment the bridge was dropped on the battlements. A figure is necessary to make us understood. Let (32) a wall A be required to be forced. First of all by means of projectiles thrown by trebuchets and mangonels, the besiegers have destroyed or made useless the defensive galleries B, have filled the ditch D, and have covered the filling by a good inclined floor. The tower is brought to the point C, started on the floor and rolls down by itself; the projections E of the calculated length butt against the foot of the wall. Their braces G are covered by strong timbers, forming a cat suitable to protect pioneers and miners if necessary. Then the bridge H is dropped suddenly; it falls on the top of the parapet, breaks the coverings of the defensive gallery, and the assaulting forces throw themselves into the upper gallery K. During this time, archers and crossbow men posted at I on the last story cover these upper galleries with projectiles, so that they dominate and disconcert the defenders, who at right and left oppose the torrent of assailant soldiers. Besides the internal ladders, at the moment of assault, numerous other ladders were placed against the rear wall of the tower, left nearly open. We have omitted in this figure the timbers and fresh hides that covered the carpentry, in order to permit the latter to be seen; but we have given in Art. Architecture Militaire, Fig. 16, one of these equipped towers at the moment of assault. About the middle of the 15 th centurw, small cannon were placed on the tops of these towers and on the lower floors to batter the foot of the walls and to cover the upper gallery with grapeshot.[1]

Note 1.p.266. Robertus Volturius, de re militori. poris.1534. Figs. of 1843.

Among machines suitable for making the assault should not be neglected the ladders frequently employed and often arranged in ingenious fashion. Galbert in his Vie de Charles le Bon s speaks of a certain ladder made to scale the walls of the castle of Bruges, that was very wide, protected by high palisades

as its base and furnished at its top with a second narrower [illegible] ed protected the assailants preparing to mount to the assault; the ladder was raised [illegible] und was lowered.

[illegible] (Old French poem).[2, 3]

Note 2.c.2?6. Verse 9114 et seq.

Note 3.c.223. Verse 9170 et seq.

The ladder furnished with movable shores seems to have been the most ingenious of all those employed in the assaults. Fig. 32 gives its side elevation at A. The entire system was placed on a carriage with blocks, that was brought to the foot of the wall to be scaled; it was composed of two sides [illegible] with rol- [illegible] like pulleys as indicated by the detail C, fitting on the timbers D F of the carriage and with two links P at the end of the rod to which were fastened two ropes, that passed around the directing pulleys F and then were coiled on the windlass [illegible]. By pressing on this windlass by two bars, the foot B of the ladder was brought to E'. Then the two pivoted shores H I rose to H I'; i.e., the triangle P H I became the triangle P' H I', its base being narrowed, and the top G of the ladder, pivoted on a cross-bar [illegible], rose to G'. Then the rope [illegible] was pulled to lower the double iron hook rotating at the top of the ladder, so as to fix the coping (see detail [illegible]). The men charged with working the windlass [illegible] advanced as the foot of the ladder approached the point P'. This sort of ladder was wide enough for three men to ascend in front to the assault. Firmly fixed at the base, supported at the middle by the two pivoted shores and hooked at the top of the parapet, powerful means were required to disturb these ladders. Besides, during this work and during an assault, the besiegers covered the ramparts with a cloud of projectiles, and they took care to surround the machines with great mantlets of wickerwork. There were also used ladders raised in sections, that slid together and thus were easily carried to the foot of the rampart to be quickly raised. The works of the 15 th and 16 th centuries on the military art are filled by models of war machines, and notably by various inventions of ladders, that it would be i

at its base and furnished at its top with a second narrower ladder to be lowered before or within the walls. The palisades protected the assailants preparing to mount to the assault; the ladder was raised by mechanism, and once raised, the second was lowered.

There are in the Roman of Ogier the Ardenois these verses. (Old French poem).[2, 3]

Note 2.p.266. Verse 6124 et seq.

Note 3.p.266. Verse 6150 et seq.

The ladder furnished with movable shores seems to have been the most ingenious of all those emplyiyed in the assaults. Fig. 33 gives its side elevation at A. The entire system was placed on a carriage with trucks, that was brought to the foot of the wall to be scaled; it was composed of two sides B C with rollers B at the base, connected by a rod; these rollers were made like pulleys as indicated by the detail O, fitting on the timbers D E of the carriage and with two links P at the end of t the rod to which were fastened two ropes, that passed around the directing pullies F and then were coiled on the windlass G. By pressing on this windlass by two bars, the foot B of t the ladder was brought to B′. Then the two pivoted shores H I rose to H I′; i.e., the triangle B H I became the triangle B′ H I′, its base being narrowed, and the top C of the ladder, that rested on a cross-bar K, rose to C′. Then the rope L was pulled to lower the double iron hook rotating at the top of the ladder, so as to fix the machine.(See detail B). The men charged with working the windlass G advanced as the foot of the ladder approached the point B″. This sort of ladder was w wide enough for three men to ascend in front to the assault. Firmly fixed at the base, supported at the middle by the two pivoted shores and hooked at top of the parapet, powerful means were required to disturb these ladders. Besides, during t this work and during an assault, the besiegers covered the r ramparts with a cloud of projectiles, and they took care to surround the machine with great mantlets of wickerwork. There were also used ladders raised in sections, that slid together and thus were easily carried to the foot of the rampart to be quickly raised. The works of the 15 th and 16 th centuries on the military art are filled by models of war machines, and n notably by various inventions of ladders, that it would be i-

impossible to employ in practice; so we shall not speak of th them here, the more because where scalades were employed, as for example under Charles V during the war of independence, besieging armies only seem to have used ordinary ladders for scaling the ramparts. The question then as now, was to bring a sufficiently great number of ladders, and rapidly enough to disconcert the defenders, and deprive them of the possibility of overthrowing all at once.

ENGINS DEFENSIFS- Defensive machines.

The sole defensive machines employed during the middle ages are mantlets. The Romans always used them in sieges, and made them of wickerwork arranged in a semicircle and mounted on t three wheels (34), or also of two panels placed at right angles, likewise mounted on three wheels (35). During the middle ages these customs were retained, and were perpetuated in the armies. Archers and crossbow men charged to shoot constantly at the battlements of the ramparts attacked, during the work of the miners or that of the engineers occupied in bringing forward towers, cats and ladders, protected themselves by l light mantlets, like those reproduced in Figs. 36, 37. These shooters must continually change place to avoid the projectiles of the besieged; it was necessary that the mantlets serving them as shelter should be easily traysported. We give in Art. Siege the general arrangement of these means of attack and defense. Before us an illustrious author had recognized t the value of these war machines of the middle ages, and how little they had been studied and appreciated; we owe it to the truth to say, that these first works placed us in the way of the new views presented in this Article. But the art of war of the middle ages would merit a special work; we should be h happy to see the little known side of arcahaeology brought to light by an author competent in these matters.

Note 1.p.289. See Precis hist. de l'influence des armes a feu sur l'art de la guerre, by prince Louis-Napoleon Bonaparte, president of the republic.

ENRAYURE. Platform. Horizontal Frame.

An assemblage of horizontal timbers on which rested the carpentry, and that maintained their horizontal distancer; carpentry might have several platforms for the stories, then are

as many assemblages or bases, permitting the shoots [illegible]
[illegible]

[illegible], Tirant.

A horizontal timber that serves as base of the triangle formed by a roof truss, and that prevents the spreading of the [illegible] the bearing rods.(?). A is a tie-beam. (Art. Charpente).

[illegible]

The name given to the opening for the key of a lock. The keyhole of a lock means the opening by which is introduced the key. (Art. Serrure).

[illegible], Entrelacs.

Only used in the plural. Thus are designated certain ornaments especially adopted during the Romanesque epoch. Scrolls of geometric drawings that are connected together, bands for forming varied designs by passing over each other, like [illegible], are interlacings in sculpture or decorative painting. [illegible]

Entresol. Entresol. Mezzanine.

A low story arranged in the height of an architectural order, presenting externally the appearance of a single story. Mezzanines were little used in the civil architecture of the middle ages, each story separated by a floor being almost indicated on the exterior by a band. Yet the architects of the middle ages were not always absolute, and however imperative the principles to which they submitted, they knew how to harmonize needs and programmes with the requirements of art; or better said, their art never refused the true expression of a need. For example, when it was necessary to place small rooms or a service galleries near the great hall, to which it was useless to give the height of that great hall between floors, these services were then mezzanined. We have given examples of these [illegible]

as many assemblages or rests, permitting the adoption of a new combination, and that connect together the entire system. Spires of carpentry, for example, have several platforms. (Arts. Charpente, Fleche).

ENTRAIT. Tiebeam.

A horizontal timber that serves as base of the triangle formed by a roof truss, and that prevents the spreading of the principals. The tiebeam may be suspended by the kingpost and the hanging rods.(1). A is a tiebeam. (Art. Charpente).

ENTREE. Keyhole.

The name given to the opening for the key of a lock. The k keyhole of a lock means the opening by which is introduced t the key. (Art. Serrure).

ENTRELACS. Interlacings.

Only used in the plural. Thus are designated certain ornaments especially adopted during the Romanesque epoch. Scrolls of honeysuckle ornament that are connected together, bands f for forming varied designs by passing over each other, like lacework, are interlacings in sculpture or decorative painting. (Arts. Peinture, Sculpture).

ENTRE-SOL. Entresol. Mezzanine.

A low story arranged in the height of an architectural order, presenting externally the appearance of a single story. Mezzanines were little used in the civil architecture of the middle ages, each story separated by a floor being almost indicated on the exterior by a band. Yet the architects of the middle ages were not always absolute, and however imperative the principles to which they submitted, they knew how to harmonize needs and programmes with the requirements of art; or better said, their art never refuses the true expression of a need. For example, when it was necessary to place small rooms or s servile galleries next the great hall, to which it was useless to give the height of that great hall between floors, these services were then mezzanines. We have given examples of these internal arrangements in Art. Construction, Figs. 119, 120.

ENTRE-TOISE. Tiebeam. Cross-beam. Collar-beam.Header.
A timber that horizontally connects two principals or two p principal beams of a floor. The trusses of the roof may receive purlins, that are placed on the principals and supported by blocks, while the cross-beams are joined to the principals by tenons and mortises. In carpentry floors the cross-beams are actual binders. (Arts. Charpente, Plancher).

ÉPANNELAGE. Blocking out.
This is the preliminary cutting of a moulding or ornament. Today in structures of cut stone, there are set stones merely blocked, the finishing being done on the work, when the construction is erected. Until the 16 th century each stone was set dressed and even carved; thus eidifices never risked remaining merely blocked, as frequently has occurred since. The Greeks and Romans set stones merely blocked, and the finishing was done after setting. There may yet be seen some Greek monuments and many Roman structures, that are merely blocked. The temple of Segesta in Sicily is only blocked. The gate Maggiore at Rome, some parts of the Coliseum, the amphitheatre at Pola, etc., have never been finished entirely.

ÉPERON. Projection. Spur.
This word is often employed for buttresses, although the b buttresses and projections are not similar parts; the buttress is an external pier intended to strengthen a wall at a thrust; the name of projection should only be applied to certain projections of masonry, angular in plan, projecting from the external cylindrical surfaces of defensive towers to keep off assailants, and to oppose the effects of battering rams or the work of miners. (These projections are also termed batters. (Arts. Architecture Militaire; construction; Porte; Tour).

ÉPI. Terminal. Top.
This name is given to certain ornaments of terra cotta or of lead, that enclose the ends of the kingposts of hip roofs at their projection above the roof. Every hip in carpentry m must join the central vertical kingpost, that cannot be cut off flush with the ridge, since it is necessary for the tenons of the hip rafters to have a strong resistance above the

mortises. A (1) being a kingpost receiving four hip rafters B, one must always leave an end B A above the tenons so that the connection may be firm. The portion B A then extends above t the covering, and it is necessary to cover it. If the roof is covered by tiles, the covering of B A at the end of the kingpost is of terra cotta; if the roof be covered by slates or lead, the covering of the end of the kingpost is also made of lead, for one cannot place lead on tiles, no more than it is proper to place terra cotta on slates or lead. The architects of the middle ages were pleased to ornament with luxury these projecting ends of kingposts of hip roofs, that are detached against the sky and thus assume much importance. In that they only followed the antique tradition, for the Romans and the Greeks before them took great care to ornament the roofs of their edifices by ornaments of terra cotta or metal outlined against the sky, and in that as in many other things, the pretended imitations of antique architecture attempted since the 17 th century vary somewhat from the models supposed to be f followed.

The terminals of the Romanesque epoch are not preserved till our days. These accessories are fragile, very much exposed to storms, and have been destroyed a long time since with the carpentry that bore them. In reliefs and manuscripts can scarcely be found a trace of these decorations before the 13 th century, and the first times of the middle ages have not left us in regard to their edifices those medals, that afford such precious data concerning the external appearance of Roman monuments.

It is necessary first to distinguish terminals of terra cotta from those of lead. The oldest terminals of terra cotta are represented in the reliefs of the 13 th century; we know none that may be earlier than that epoch, they appear to be composed of several pieces extending into each other and terminated by a cap. Here (2) is the most common form of the terminals of that epoch. They usually represent a little column with its capital covered by a cone. The profile A B indicates the different parts composing the terminal enclosing the end of the kingpost. The bottom piece is the last ridge tile covering t the end tiles of the hip of the roof.

As architecture became richer and the crownings of edifices became more cut-out, it became necessary to give more import-

importance to those details detached and outlined against the sky. There exist some fragments of terminals of terra cotta f from the beginning of the 13 th century in provinces , where the material was employed by skilful hands. Troyes is one of the cities of France where manufactures of terra cotta were particularly flourishing during the middle ages; it possessed a few years since a great number of very beautiful terminals of glazed terra cotta, that have mostly been destroyed or removed. M. Valtat, sculptur at Troyes,has collected one of the most remarkable specimens of this decoration of roofs. It is in one piece not less than 2.5 ft. high, and was terminated by a strong iron rod probably receiving a vane. The base A B is wanting, and we have restored it here to complete this ornament. At the end of the shaft expands a capital with leaves forming a little circular structure terminated by five gables and a cone pierced at top. The whole is lead-glazed green and yellow, and the little openings imitating windows are pierced neatly by means of a cutting tool. It is easy tc see that this pottery was modeled by hand, for there appear many irregularities; the work is coarse, and it is the composition and style and not the execution, that recommends our example.The iron rod simply extends into the end of the kingpost of the carpentry as indicated by the section D. This was an ordinary object; one cannot doubt this, when he sees at Troyes ind in the vicinity the quantity of remains of pottery of this kind that s still remains on the roofs of houses or the edifices. Ceramics is an art behind the others; makers continue traditions often no longer in harmony with the age; this explains the Romanesque appearance of this terminal, to which cannot be assigned a date earlier than 1220. A certain number of these objects further remained several years in the manufactory before being sold, and it was only later that the potters decided to modify their models. These little shafts supporting small structures were long accepted for the decoration of kingposts, yet about the end of the 13 th or beginning of the 14 th centuries, this type was too much out of harmony with the architectural forms of that epoch; men came to pinnacles of terra cotta to crown hips or hip roofs covered by tiles.

There is seen in the museum of the bishop's palace at Troyes one of these terminals taken from the old city hacc (4); we

believe it might have been made about the middle of the 14 th century, it is square in plan, decorated by little openings o only accented and filled with a brown glaze, four gables and a pyramid with four niches. The upper cross-flower B is broken and the part C of the base is lacking, i.e., the existing portion is that between A and B. This terminal is glazed in reddish-brown and yellow, like the tiles of the 14 th and 15 th centuries; it must have been terminated by an iron rod and a vane. Its execution is coarse, made without moulds, the whole seeming made by hand; but it must be recognized, that at the height at which these objects were placed, there was no need of careful execution to produce the effect. Men went to the factory for these terminals, just as one goes today for flower pots and ordinary pottery, and used them such as they were. Soon these forms seemed too stiff and not sufficiently opened, stone pinnacles covered by projecting crockets and r ridges of roofs flowered, the terminals of terra cotta were given an appearance less architectural and freer, it was desired to find perforations and pronounced projections, their principal stem was made more slender; it no longer enclosed the end of the wooden kingpost, but an iron rod.

However the use of tiles was less common, these being replaced by metal or slate; terminals of terra cotta consequently became less common.

We drew at Villeneuve-l'Archeveque some years since a terminal in terra cotta on a house dating from the 15 th century; it was composed of three pieces (5), entirely covered by brown glaze; the joints A and B; the iron rod that held the pottery was fixed on the stump of the kingpost, as indicated at A.

The 16 th century replaced the terminals of glazed terra cotta by terminals of faience, i.e., of enameled clay. The suburbs of Lisieux possessed a great number from the factories of the valley of the Orbec;[1] most of those objects have been purchased by dealers in curiosities, who sèll them to amateurs as Palissy faience, and today it is necessary to go farther to find some of these faience terminals of the Renaissnce, so common twenty years since. One of the most remarkable among these products of Norman industry is found at the chateau of S. Christophe-le-Jajolet. We give here (6) a copy.[2] This faience terminal is composed of four pieces, whose joints are at

A, B, C. The whole is strung on an iron rod. The base is yellow spotted with brown, the vase is light blue with yellow ornaments and heads in natural colors, the flowers are white with green leaves and yellow balls, the stem is white, the ball is bistre yellow,and the bird white spotted with brown.

Note 1.p.276. See Bull. mon. of M. de Caumont. Vol. 16. Notes on some ceramic processes of the middle ages.

Note 2.p.276. This drawing was furnished by M. Ruprich-Robert.

The faience factories of Rouen, Beauvais,and Nevers, supplied these objects of external decoration to all the adjacent provinces; unfortunately negligence, love of novelty and the fashion of roofs without any decoration have caused them to disappear, and the museums of those cities have not known how to save some remains. The new ideas, that in the 17 th century tended to take from our national architecture its originality, gradually destroyed that provincial manufacture, prosperous even in the 16 th century. The art of the potter longer resisted that sad influence than any other, and under Louis XIII men continued to make crestings and terminals of enameled or glazed terra cotta, to ornament the roofs of private houses. The museum of the cathedral of Seez possesses a terminal of that epoch, however rude it is, that preserves some remains of those traditions of the middle ages; that is why we present a copy of it here (7). This terminal is entirely covered by a greenish brown enamel.

Lead lends itself much better than terra cotta to the execution of these upper decorations of roofs, so it is employed for making terminals on roofs, always when these are covered by metal or slates. In the 12 th century and before that epoch, there were employed only tiles for covering roofs, and exceptionally lead; slate was in use only in our provinces where schist is abundant. (Arts. Ardoise, Plomberie, Tuile). Then only on monuments built with l xury were placed terminals of lead, and the coverings of metal placed before the 13 th century no longer existing, it would be difficult for us to give examples of terminals preceding that epoch. The oldest terminal that we have seen and drawn is found on the roofs of the cathedral of Chartres;[1] it was placed at the centre of the crossing and might have a height of about 3.2 ft. It was a beautiful work in hammered lead, but very dilapidated.(8). Its cross-

flower was divided into four leaves with four intermediate b buds. A large ring decorated by great beads served it as a base. It is to be believed that its support was a forked iron bar enclosing the head of the wooden kingpost.

Note 1.p.279. This covering of the carpentry supporting it dates from the second half of the 13 th century; the carpentry was burned in 1836.

About the end of the 13 th century slate roofs became very common and replaced tiles nearly everywhere, but to which however Burgundy, Auvergne, Lyonnais and Provence remained faithful. The ridges and terminals of lead then became more common. We still possess a very great number of examples dating from the 14 th century. There exists one of these terminals on the building located behind the apse of the cathedral of Laon. H Here is another (9) that crowns the stair turret of the hall called of the Maccabees, dependant on the cathedral of Amiens. This terminal is entirely hammered and is modeled with extreme care; it dates from the epoch of the construction of the hall, i.e., about 1330. At A we present the section of the stem at a b and the plan of the ball made of two shells soldered together. The terminal is maintained by an iron rod fastened to the head of the kingpost of the carpentry.

On the north gable of the trtnspet of the cathedral of Amiens is still seen a very beau iful terminal of lead with two rows of leaves, that dates from the end of the 14 th century or beginning of the 15 th. This terminal crowns a half timber construction that replaces after that epoch the stone gable. Much too delicate for the height at which it is placed, it is better suited for crowning the roof of a chateau. We give a reproduction (10); each group consists of three much divided leaves, strongly modeled by hammering, and forming in plan two changed equilateral triangles. Under the ring are soldered small leaves of cast lead; indeed after the 15 th century is seen cast leadwork, employed at the same time as hammered leadwork. But we shall treat this matter in detail in Art. P Plomberie. It is evident that the lead terminals follow the transformations of the architecture; this becomes lighter and more open, these crownings become more slender and leave more openings between their ornaments, seeking for affected details. Still the outlines are always happy and are detached against

the ary so as to leave their importance to the principal [illegible]

[illegible]

the half timber gables of its great dormers, on its turrets and on the ridge of its roofs beautiful terminals of the 15 th [illegible] ly of hammered lead, partly of cast lead. We give here (11) a copy of one of them. The upper groups of leaves, whose detail is seen at A, are of hammered lead, the crown and canopy, detailed at B and C, are formed of bands cast in moulds and soldered to circular rings. The base of the terminal is entirely made of hammered work, except the attached ear, which is cast. Burgundy was in the 15 th century a rich and powerful province, and its inhabitants could allow themselves to ornament the roofs of their mansions and houses by beautiful leadwork while in the North of France, ruined by the wars of that epoch, could not devote itself to luxury in private structures. Thus in spite of the work of fury exercised for more than a century to suppress the old ornamental crowns of roofs, there yet remain in the cities of Burgundy some forgotten examples of these terminals of the 15 th century.

At Dijon, several exist on private houses, notably on Petite Rue Pouffier. (1). At 4 we give the half plan of the kingpost, whose base is a concave curvilinear triangle after the [illegible]. Dating from the 14 th century, one very frequently finds the finials of terminals decorated by prisms or cylinders, that intersect each horizontally, and that terminate by a flower or pomegranate. These kinds of finials produce a very happy outline. It should not be forgotten to mention here some lead terminals, that surmount still the roofs of the mansion of Jacques Coeur at Bourges, whose bases are ornamented by leaves in low relief, shields and rosettes. Frequently lead terminals were painted and gilded, which adds much to the effect, that they produced at the tops of the roofs.

The epoch of the Renaissance, that in changing the details of Gothic architecture still retained the general system, especially in private houses, and did not neglect the luxury of lead work. As before, the roofs were enriched by crestings and terminals. The recourse then to hammered lead and abandoned almost everywhere the process of casting. Several chateaus and mansions of that epoch still retain very beautiful termi-

the sky so as to leave their importance to the principal masses.

The hospital of Beaune, founded in 1441, still retains on the half timber gables of its great dormers, on its turrets and on the hips of its roofs beautiful terminals of the 15 th century ending with armorial vanes. These terminals are partly of hammered lead, partly of cast lead. We give here (11) a copy of one of them. The upper groups of leaves, whose detail is seen at A, are of hammered lead, the crown and canopy, detailed at B and C, are formed of bands cast in moulds and soldered to circular rings. The base of the terminal is entirely made of hammered work, except the attached sun, which is cast. Burgundy was in the 15 th century a rich and powerful province, and its inhabitants could allow themselves to ornament the ro roofs of their mansions and houses by beautiful leadworkl while in the North of France, ruined by the wars of that epoch, could not devote itself to luxury in private structures. Thus in spite of the sort of fury exhibited for more than a century to suppress the old ornamental crowns of roofs, there yet remain in the cities of Burgundy some forgotten examples of these terminals of the 15 th century.

At Dijon, several exist on private houses, notably on Petite Rue Pouffier. (12). At A we give the half plan of the kingpost, whose base is a concave curvilinear triangle under the ring. Dating from the 14 th century, one very frequently finds the rings of terminals decorated by prisms or cylinders, that intersect them horizontally, and that terminate by a flower or quatrefoil. These kinds of rings produce a very happy outline. It should not be forgotten to mention here some lead t terminals, that surmount still the roofs of the mansion of Jacques Coeur at Bourges, whose bases are ornamented by leaves in low relief, shells and hearts. Frequently lead terminals were painted and cilded, which adds much to the effect, that they produced at the tops of the roofs.

The epoch of the Renaissance, that in changing the details of French architecture still retained the general system, especially in private houses, and did not neglect the luxury of leadwork. As before, the roofs were enriched by crestings and terminals. Men returned then to hammered lead and abandoned almost everywhere the process of casting. Several chateaus and mansions of that epoch still retain very beautiful termi-

terminals ornamented by fruits, capitals, leaves and even by figures, the whole hammered with much skill. Among these terminals may be cited those of the mansion du Bourgtheraulde at Rouen, the chateaus of Amboise and of Chenonceaux, the palace of justice at Rouen. Very beautiful ones, though mutilated, are seen on the dormers placed at the base of the spire of t the cathedral of Amiens in the valleys.

We reproduce one (13) of these terminals whose leadwork is hammered by a very skilful hand. It would be difficult to t tell what Cupid is doing on the roofs of Notre Dame of Amiens, but that figure is found frequently repeated at that epoch at the tops of terminals. One also sees some of those children drawing the bow on the houses of Rouen built at the beginning of the 16 th century. At the top of the chevet of the apsidal chapel of Notre Dame of Rouen exists a very beautiful terminal of the 16 th century, which represents the Holy Virgin holding the Child. As leadwork, it is a remarkable piece.

At the end of the 16 th century, the terminals lost their special character; they represent vases of flowers, little columns with capitals, cooking pots, and chimeras attached to balustrades. As one approaches the 17 th century, the art of leadwork continues to become weaker, although under Louis XIV were again executed very beautiful works of this kind, but then it was only applied to great monuments, to princely habitations; it is then a luxury not permitted to the simple private individual. (Arts. Crete, Girouette).

Note 1.p.287. It is necessary to say that quite recently th this art or industry, if you prefer, has resumed a certain importance. This is again one of the souches of wealth, that we owe to the study of the arts of the middle ages.

ESCALIER. Stairs. Stairway. Staircase.

We shall distinguish between external stairways (that should not be confused with flights of steps) from internal stairs, stairs with straight flights from stairs with turns and circular, stone stairs frsm stairs of wood. In Roman edifices, excepting theatres and amphitheatrer, the stairs are very narrow and not numerous. Besides, the Romans employed stairs with st-straight flights and screw stairs; but the do not appear (at least in interiors) to have ever regarded the stairway as a

motive of monumental decoration, as done in modern times. The stairs of an antique edifice are a need satisfied in the simplest manner, and a means of communication from one story to another, nothing more. We shall not decide in this whether the a ancients were wrong or right; we only state the fact, so that one cannot accuse the architects of the first times of the m middle ages as remaining in that far below their masters.

Besides, the architects of the middle ages, like the Roman architects, had never established in a building a stairway, whose flights would obstruct the arrangement of openings, as freely done in our time, even in great edifices. The Romans reserved the monumental arrangement of the stairs for external flights of steps under the open sky. In the interior they always placed the flights perpendicular to the front wall, so t that the heights of the landings could accord with the heights of the floors, and consequently with the arrangement of the o openings; but we shall return to that important question.

However little one may be occupied with internal arrangement, he knows how difficult it is to properly arrange the stairs, either to satisfy the programme, or not to interfere with the external or internal arrangement of the architecture. The ancients did not solve the difficulty; this was a means of not having to solve it.

The most common Roman stairs is arranged thus.(1). It is c composed of two flights separated by a division wall, and first reaching the mezzanine landing A, the second landing of the second story B, etc. The steps are then borne by the rampant vaults, if very wide, or simply arranged at the ends in the walls, if the treads are narrow. Thus are conceived and executed the stairs of baths, theatres and Roman amphitheatres. Men sought no other system of stairways in the first monuments of the middle ages. But it is easy to see that these double flights always led to over the starting point, which in many cases could not be done in the arrangement; then men had recourse to the screw or snail stairs, that present this advantage of ascending in a small area to all points of the circumference of the cylinder in which rise this sort of steps. These first principles being established, we shall occupy ourselves at f first with stairways with straight flights, external and covered or uncovered.

ESCALIERS EXTERIEURES. External Stairs.

Although this sort of stairs is rarely constructed today, it must be recognized that they were very convenient, because interfering in nowise with the internal arrangement, and did not intersect the building from top to bottom, thus intercepting the principal communications. One of the oldest and most beautiful stairways so arranged is still to be seen in the enclosure of the buildings of the cathedral of Canterbury. This stairway was built in the 12 th century, and is situated near the principal entrance, leading to the reception hall (hall of the stranger); it is composed of a broad flight perpendicular to the entrance of the hall with upper landing; it is c covered, and the roof with horizontal plates, is supported by a double open and very rich arcade, whose columns diminish a according to the rise of the steps.[1]

Note 1.p.289. See Some Account of Domestic Architecture in England, from the Conquest to the end of the 13 th century, by T. Hudson Turner. J. Parker. Oxford. 1857.

Most great halls of castles were situated in the second story, and one ascended there either by wide flights of steps, or by narrow covered flights, beside or perpendicular to these halls.

The great hall of the castle of Montargis, that dates from the second half of the 13 th century, possessed a stairway with three flights with a gallery of communication supported on arches. (Art. Chateau, Fig. 15). That stairway was arranged in such fashion, that from the great hall A (see plan, Fig. 2), one could descend to the area of the court by the three flights B, C, D. It was covered by wooden roofs placed on columns and piers of stone.[2] In palaces, this sort of stairs was called the steps in particular. The flight had the name of "epuiement;"[3] (old French poem).

Note 2.p.289. See Du Cerceau, Des plus excellens batiments de France.

Note 3.p.289. Lai d'Yweyec. poems of Marie de France, 13 th century.

The coverings of these narrow ramps were either of wood, as at Canterbury and Montargis, or vaulted as much later at the Chambre des Comptes and at S. Chapelle of Paris. These two last stairs ascended along the building. That if the Chambre

des Comptes, erected under Louis XII, was a masterpiece of e elegance; it landed at a portico A opening on the apartments. (Fig. 3, plan). This portico and the porch B were vaulted, t the flight was covered by a wooden ceiling. On the front of the porch was seen in relief a crowned shield of arms of France, having as supports two winged stags, the crown passing a around their necks, and the taband of the herald of arms of France displayed behind. Beneath the shield was a porcupine surmounted by a crown, with this legend beneath. (Latin verse). The whole on a ground spotted with fleur-de-lis and crowned dolphins. The fleurs-de-lis were then carved on the tympanums of the arches and on the pilasters. The solid balustrade presented in relief Ls passing through crowns, then dolphins.[4]

Note 4.p.289. See Topog. of France; Imp. Library.

To ascend to the upper galleries of fortifications were established after the 12 th century long straight flights along the curtains with a parapet at the top. The steps then rested on arches, and were always moulded at the riser, which gave greater breadth to the step and produced a very good effect, very clearly indicating the purpose of these flights, very l long if the upper gallery was very high above the ground inside the city.

At Aigues-Morts, Avignon, Villeneuve-les-Avignon, Jerusalem, Beaucaire, Carcassonne, are still seen a number of these external uncovered stairs, that have a very monumental appearance. (4).[1] But if frequently occurred for want of room or to avoid the construction of these arches, or when it was necessary to ascend along a very high rampart to the top of a square tower, the steps of uncovered stairs were corbelled. To give these steps sufficient projection to allow two persons to pas and for perfect stability, the architects obtained the desired projection by a very ingenious procedure in construction. Each step was cus as indicated in the sketch A (5), the part B being destined to be engaged in the wall. Setting the steps so combined on each other, so that the point C falls on the point D, they were always supported by a series of steps presenting a solid corbelling as sohown in the perspective sketch G, the elevation H and profile K. One of these stairs, perfectly executed, is still seen in the interior of the socalled tower of Orange at Carpentras (beginning of 14 th century).

Ordinarily for stairs to be easily practicable, it is necessary for each step to have as width the length of a man's foot, say 11.0 to 11.8 ins., and a height of 5.9 to 7.9 ins. at most, which gives an inclination of about 22 degrees. But sometimes space is lacking to obtain such a gentle slope, and one is compelled, especially in fortifications, to ascend at an angle of 45 degrees, that gives steps as wide as high, making the ascent dangerous or very toilsome. In such a case the constructors, observing correctly that one only placed one foot at a time on each step, either to aslend or descend, and consequently that it was useless for a step to have the width required for setting the foot along its entire length, those constructors arranged a wedge-shaped step, as indicated in Fig. 6, so that the two steps taken together would have 11.8 ins rise and tread at one end, which allowed the flight of stairs to be ascended within an angle of 45 degrees. But it was always to place the left foot on the step A, and the right foot on the step B in descending, or the reverse in ascending. The perspective C will make understood the system of these steps.[1] One will recognize here, that subtlety was not lacking in our architects of the middle ages. But these last examples furnish only service stairs.

Note 1.p.291. From the ramparts of Carcassonne, end of 13 th century.

Note 1.p.295. A stairs of this kind is still seen in the up upper parts of the church S. Nazaire of Carcassonne, and at Notre Dame of Paris in the galleries of the transepts.

ESCALIERS INTERIEURES. Internal Stairs.

That is, serving several stories of a building, placed within enclosures comprised in the structures or added thereto. As we have already seen, screw stairs were employed by the Romans; the architects of the middle ages adopted that system in preference to any other, varying the dimensions of the stairs at the newel according to the services that they must sa satisfy. This sort of stairs presented several advantages important to mention:- 1, they could be enclosed within the structure or be attached to it only by a small segment; 2, they occupied little area; 3, they allowed doors to be opened at all points of their circumference and at all heights; 4, they were easily lighted; 5, these were of simple construction and

easily executed; 6, they were inclined gently or rapidly as desired; 7, for castles or towers, they were barracaded in a moment; 8, they ascended from the ground to considerable heights without affecting the stability of the adjacent construction; 9, they were easily repaired.

The oldest screw stairs of the middle ages consist of a newel of cut stone, and of a round tower structure, and of a helical tunnel vault built of rubble, resting on the newel and the internal cylindrical surface. That vault supports the stone steps with edges set on the radius of the circle. Fig. 7 represents the plan and section on the line A B of the plan, one of those stairs so common in the edifices of the 11 th and 12 th centuries. The external door of the stairs being at D, the first step is at C. These steps are set on a solid as far as the line G; beyond this commences the relical vault r represented in the section. The drums of the newel bear a small projection H to receive the springing of the tunnel vault, t that on the other side is engaged in the cylindrical wall I. The steps are set on the extrados of the rampant tunnel vault, and are composed of one or several pieces for each. Generally these rampant vaults are very rudely built of small rubble s set on centerings. The vaults of the abbey church of Eu, which date from the 12 th century however are executed with great precision, but the Normans were then very careful stonecutters. Here in Fig. 8 is now are cut the drums of the newel that receive the springing of the rampant tunnel vault; it also occurs that the support of the vault is notched into the cylindrical newel, which weakens it much. This sort of stairs rarely exceeds 3.3 ft. length of step, and is often less, the cylindrical enclosures having only about 5.9 ft. diameter, from which deducting the newel, in this kind of stairs at least o one foot in diameter, there remains for the steps at most 2.6 ft. One soon recognized that the rampant vault could be omitted; when at the beginning of the 13 th century stone was quarried in larger blocks than ever before, it was found simpler to make a part of the newel on eamh step, to lap them a little on each other, and to arrange a bearing extendinm some ins. into the cylindrical wall of the enclosure. This procedure a avoided centering and forms and much work at the place, it a also had the advantage of connecting the newel with the wall

by all the steps, that formed as many shores. These steps could be cut in advance from a single drawing, and a stair could be built very rapidly. One should not lose sight, that among so many innovations introduced into the art of building by t the lay architects of the end of the 12 th century, the necessity of quickly attaining a result, in brief of building quickly, was one of the most apparent needs.

Fig. 9 gives the plan and section [1] of one of these stairs. The external door is at A, the first step being at B. The layers are indicated by the dotted lines, and the detail C presents one of the steps in perspective with the dotted lap of the succeeding step. Sometimes to facilitate passage the steps are chamfered beneath as seen at D. The dimensions of these stairs vary, the steps of some are only 20 ins. long, the largest are not more than 6.6 ft., which required very long stones; thus to make the steps of the grand stairway of the Louvre, Charles V was compelled to purchase old tombs at the church of holy Innocents,[1] probably because the quarries of the Paris lias could not supply at that time the number of blocks of the desired dimensions; in fact this stairway was very wide; we shall return to it. In interiors of castles screw stairs were singularly multiplied; besides those ascending from the ground and serving all the stories, there are some that established in the thickness of the wall communication between only two stories, and used only by the persons occupying these superposed apartments. Concerning the dominion that queen Blance of Castile had retained over the mind of her son, Joinville relates:- "That the queen Blanche would not allow by her power, that her son should be in company with his wife, nor for him to sleep with her at night. The place where it pleased her most to live was at Pontoise, between the king and queen, because the chamber of the king was above and the chamber of the queen was below (her own). And having them that their conversation should be on a screw stairs descending from one chamber to the other; and these arrangements were made in advance, so that when the ushers saw the queen (mother) come into the the chamber of her son the king, they struck the wainscot with their rods, and the king ran into his chamber, for fear that his mother should not find him there; and thus did the ushers of the chamber of the queen Marguerite when the queen (mother)

Blanche came there, so that she should find there queen Marguerite. Once the king was beside the queen his wife, and she was in two great danger of death, for she was injured by an infant, that she had had. There came queen Blanche, took her son by the hand and said to him; come away, you do not belong here." [1]

Note 1.p.297. The section is made on a b with elevation of the newel to show the lapping of the steps.

Note 1.p.298. Souvol.

Note 1.p.299. Memoires du sire de Joinville, published by F Fr. Michel. p. 190. Paris. 1958.

These stairs, placing in communication two superposed rooms, were not always made at the expense of the thickness of the walls; they were visible in part, placed in an angle or along the wall of the lower chamber and lighted from that room. In this respect it is important to be impressed by the principles, that directed the architects of the middle ages in the c construction of stairs. These architects never saw in stairs anythiyg but an indispensable appendage to every edifice composed of several stories, an appendage to be placed so as to be most convenient for the service, as one places a ladder b beside a building under construction, just where the need is felt. The idea of making the stairs a sort of theatrical decoration in the interior of the palace, of placing that decoration in a symmetrical manner to only reach secondary services, taking an enosmous area to develop double flights, that idea never entered the mind of the architect of antiquity or the middle ages. A stairway was only a means of reaching the upper stories of a habitation. Besides the great halls of castles were always placed about in the ground story, i.e., above a low story generally vaulted, a sort of cellar serving as a storehouse. The floors of the great halls were reached by broad flights of steps, like those of the palaces of Paris and of Poitiers, or by external flights as at the castle of Montargis. (Fig. 2). Stairways properly socalled, then generally served only the private apartments. Every great assemblage, destival, ceremony or banquet, was held in the great hall; it had not been utilized to establish long steps for the stories frequentel by servants. the important matter was to arrange these steps near the rooms to which they must give access.

This explains the great number and narrowness of the stairs of castles until the 1; th century. Still we hawe just stated, that at the Louvre of Charles V had already caused the construction of a great winding stairway to ascend to the upper s stories of the palace; but that was an exception, so this stairway passed as a work without its like. Sauval [1] has left us a very extended description of this st irway, which merits be-being given entire.

Note 1.p.300. Hist. de la ville be Paris. Vol. II, p. 23. "The grand stairway, or rather the grand screw of the Louvre," (since at that time the name of stairway was unknown), "that great screw," I say, -was built in the reign of Charles V, a and directed by Raymond du Temple, mason in ordinary of the king.[2] Now it is necessary to know that the architects of past centuries never made their stairs straight nor square, nor in two, three or four flights, as these had not then been invented,[3] but always circular and winding, proportioning the best possible their dimensions to the size of the houses.[4] The great screw stairs of this palace was all of cut stone like the rest of the building, and the same as the others of that time; it was terminated by another very small (screw), also all of stone and of like form, that led to the terrace (by which was crowned the great stairway); each step of the little (screw) was three feet long and one and a half ft. wide, and for those of the great one, they were seven ft. long by one half thick, with two and a half ft. tread next the circular wall enclosing it."

Note 2.p.300. Raymond du Temple was sergeant-at-arms and at the same time master of works of king Charles V.

Note 3.p.300. Sauval is here in error, these kinds of stairs were invented in the Roman epoch; but in truth, the architects of the middle ages always preferred the screw stairs, from the motives just deduced.

Note 4.p.300. Sauval in this does justice to our old masters of works, who built their stairs proportioned to the services that they must satisfy.

"It is seen in the registers of the Chambre des Comptes, t that these together rose 94.5 ft. high,[5] that the great (screw) consisted of 83 steps,[6] and the small one had 41;[7] they were made in the usual way of stone brought from the quarries around

Paris. And since to do this these quarries had been exhausted, in order to finish they were compelled to have recourse to the cemetery of S. Innocents, and trouble the repose of the dead: so that in 1365 Raymond du Temple, director of the work carried away 20 tombs on Sept. 27 th, that he purchased for 14 Paris sous each from Thibault de la Nasse, warden of the church, and finally caused them to be cut by Pierre Anguemond and Jean Colombel to serve as a landing.

Note 5.p.300. I. e., the lost step of the stairway was about 65.6 ft. above the ground of the court, and thus must serve two stories above the ground story together with the terrace.

Note 6. p.300. At 0.5 ft. each, this makes about 43.6 ft.

Note 7.p.300. At 0.5 ft. each, this makes about 21.7 ft. T These measures in detail accord with the general measure and produce about 65.6 ft.

"We saw it (that stairway) destroyed in 1600, when Louis XIII caused the edifice of the Louvre to be resumed under the direction of Antoine Lemercier. To make it more visible and easier to find, master Raymond placed the masterpiece entirely in the court,[1] against the body of the building that looked on the garden;[2] and to make it more superb (the stairway), h he enriched the exterior by low reliefs and by 10 great figures of stone, each covered by a canopy, placed in a niche and supported on a pedestal; at the second story beside the door were two statues and two sergeants-at-arms made by Jean of S. Romain,[3] and around the enclosure were distributed outside with neither order nor symmetry, from top to bottom of the enclosure, the figures of the king, the queen and their male children;[4] Jean of Liege worked on those of the king and queen; Jean of Launay and Jean of S. Romain divided between them the statues of the duke of Orleans and of the duke of Anjou; Jacques of Chartres and Guy Dampmartin, those of the dukes of Berry and of Burgundy; and these sculptors had 20 francs in gold or 16 livres Parisis for each figure. Finally, that screw (stairs) was terminated by figures of the Virgin and of S. Jh-John of the design of Jean of S. Romain; and the gable of the last window was covered by the arms of France,[5] by fleurs-de-lis without number,[6] that had as support two angels and for an apex a crowned helmet, also supported by two angels and c covered by a bell decorated outside by fleurs-de-lis. A serg-

sergeant-at-arms 3 ft. nigh and sculptured by S. Romain guarded each door of the apartments of the king and queen oppening from that stairway; the vault ending it had 12 ribs, and on the boss were the arms of their majesties, and in the compartments (fillings between the ribs) those of their children,[1] and was wrought (the sculpture of that vault), much by the s same S. Romain as by Dampmartin, for 32 livres parisis or 40 francs in gold."

Note 1.p.301. This was indeed the end proposed by the architects of the middle ages. Further, by thus placing the great stairways as masterpieces, they did not disturb the internal arrangement, had as many windows as desired, and arranged the landings without difficulty.

Note 2.p.301. I.e., meaning within the building on the north. (Art. Chateau, Figs. 20, 21, 22).

Note 2.p.301. It is evident that Raymond signed his work by thus placing two sergeants-at-arms at the sides of the principla door opening in the second story of the stairway.

Note 4.p.301. Sauval evidently means here, that these lost statues were set according to the tread of the stairs. Indeed, in these screw stairs the architecture followed the slant of the steps, and the statues must rise at each pier to harmonize with the architecture.

Note 5.p.301. The gable of the last window.

Note 6.p.301. Charles V at first did not charge the shield of France with three fleurs-de-lis, this change in the arms of France was therefore only later than 1365.

Note 1.p.302. There can only be a question here of the vault raised at the top of the little screw.

It is necessary to add to this description, that this stairs communicated with the great tower of the Louvre by means of a gallery, that must have been built also under Charles V, for from the time of Philip August the keep was entirely isolated. Let us then attempt to restore this very interesting part of the old Louvre by the aid of these exact statements and similar materials, that remain to us in the castles of the 15 th and 16 th centuries. The great winding stairway of the Louvre was entirely detached from the building at the north, and was only joined to it by a sort of landings: this results from the text of Sauval; on the other side the stairway was in commun-

communication with the keep by a gallery. This gallery must n necessarily form an open portico in the ground story, to not intercept the communication from one court to the other. Arranging then the spaces necessary for the entrance of the portico and the entrance into the north building, taking account the length and width of the steps, noting that on the exterior the architect was able to place 10 great statues around the ground story in the niches surmounted by canopieu, and that consequently these figures could only be flaced on the fronts of the buttresses, and taking into account the 12 ribs of the vault mentioned by Sauval, of the length and width of the steps of the little screw, we are led to trace the plan of the ground story, Fig. 10. At A is the connection with the north building. At C is the portico supporting the gallery connecting the stairway to the keep. The first step is at D. Up to the landing E, taking into account the tread of the steps, we find 16 steps. Sixteen more steps lead to the second landing placed over the vault F. Sixteen steps arrive at the third landing over that at E. From this third landing one ascends one flight to the fourth landing over that at E by 35 steps, a total of 83. The central newel, large enough to support the little upper stairs, must be opened in the ground story to allow direct passage from the portico C to the building B. Above this open newel could be intended, as frequently practised, te receive lamps to light the steps at night. The first flight was probably set on a solid or on low vaults; the second rested on v vaults G, that permitted passing around that flight. Our plan gives us at H 10 buttresses able to receive 10 great statues. A section, Fig. 11, made on the line C B, explains the revolutions of the flights and the various landings on a level with the stories of the building B. That indicates to us the structure of the open newel, and at K the level of the last landing of the grand stairway, starting from which the small screw begins ts ascend, having 41 steps up to the level of the upper terrace. This little screw has its windows in the enclosure of the great stairway by means of stepped arches. It is unnecessary to say, that we do not pretend to present these Figs. as an accurate drawing of this monument destroyed from the 17 th century, and of which no drawing remains; we attempt here to summarize our study and different combinations em-

employed by the architects of the 14 th and 15 th centuries, when they desired to give to their stairways an entirely monumental appearance. One understands very well how Raymond du Temple procured with difficulty such a considerable number of steps and landings of great dimensions, able to offer a perfect resistance, since according to the method then adopted, these steps, excepting those of the two first revolutions, were only supported at their ends. As for the landings, that it wo would have been impossible to make of a single slab, we nave assumed them to be supported, either by vaults or by open arches, as indicated by the perspective view (12) taken below the upper landing.

The architects had become very skilful geometrical draftsmen from the end of the 13 th century, and found in the composition of stairways a subject suitable to develop their knowledge and arouse their imagination. Their system of construction a and their style of architecture lent themselves marvellously to the use of complex combinations, learned and impressed by great freedom; thus (although the existing monuments are unfortunately very rare), the descriptions of castles and monasteries mention remarkable stairways.

For example, these great winding stairs of palaces often had a double revolution, so that men could descend by one and ascend by the other without meeting or even seeing each other. At other times two screws rose, one within the other; one in the inner, and the other in the outer enclosure; a combination of which one can form an idea, by arsuming that the little screw in the section Fig. 11 descends to the ground story. The internal screw becomes a service stairs, and the outside winding stairs is a stairway of honor. Independently of the advantages to be derived from these combinations, it is certain that the architects, as well as their clients, were pleased by these r refinements in construction, in the castles where the days s seemed very long, these oddities and surprises were so many distractions from the monotonous life of the owners and their guests.

"One saw at the Bernadins of Paris," says Sauval,[1] "a screw turning around a double column (newel), where one enters by two doors, and where he ascends by two ways without one being able to be seen in the other; that screw has 10.7 ft. diameter,

and each step has a height of 8 to 9 incs. The steps are chamfered and are not covered by other stones. This is the simplest stairs and the rarest in Paris, all the steps are chamfered underneath. Its beauty and its simplicity consist in the treads of both, showing about a foot, that are indented, wedged, fitted, inset, dowelled into each other, binding each o other in a manner as firm as pleasing. The steps at the other end are supported by the enclosing wall of the tower; these t two stairs equal each other in all their parts; the style of the newel is similar from top tc bottom, and the steps are e equal in length, breadth and height. The church and the stairs were commenced by Pope Benedict XII of that name, of the order of S. Bernard, and continued by a cardinal of the same order named Willian. These stairs have only two windows, one lighting both at top, the other at the bottom.[2]" In seeking to explain by a Fig. the description by Sauval was made the plan. (13). At A and B are the two entrances, at C and D the first two steps; the number of steps to ascend from C to E, considering the height of these steps, allows height under t the tread F for taking the second flight D; the flights thus continue to ascend by one passing beneath the other. It is c clear that two persons ascending from C to D could neither see nor meet each other. Sauval also describes very pretty stairs found at S. Mederic of Paris, and that date from the end of the 14 th century. Here is what he says:-

Note 1.p.306. Hist. et antiq. de la ville de Paris. Vol. IV; Vol. I, p. 435.

Note 2.p.306. It was in 1336 that Pope Benedict XII commenced the church of Bernardins of Paris.

Note 1.p.307. Hist. et antiq. de la ville de Paris. Vol.I p.438.

"There exist two S. Gilles' screws en the two turrets at t the two sides of the masterpiece window. One is prismatic and the other is round. Both were designed by a very learned architect, greatly skilled in stonecutting. The round one is covered by a spherical or shell vault, so well and so smoothly c constructed, that it is difficult to find one whose very soft and bold lines may be better designed or better executed. Its beauty consists especially in six doors that all meet together at the same place on the same landing, as well as the lines of

their jambs, and this without confusion, a surprising and admirable thing. The round column and this screw in some places is twisted or wavy, and although the lines start from two edges where the wave stops, they are always so well designed, t that the vault is always and everywhere of a similar arrangement.

The other prisamtic screw is sometimes pentagonal and sometimes hexagonal. Its newel is very slender and its edges are sharp, and it is designed from top to bottom with the same d delicacy and excellence as the other. The marvel of these two screws consists in their smallness and the thenness of the w walls supporting them, not exceeding 9 ins. thick."

We should not end if we wished to cite all the texts relating to the stairs of the middle ages, and especially those of the beginning of the Renaissance, for it was at that epoch t that were built the most beautiful and surprising winding stairs in the residences of the nobles, the mansions and even t the monasteries. In the description of the abbey of Theleme, Rabelais could not fail tc mention a masterly winding stairs, , "a hundred times more magnificent" than that of Chambord. "In the middle of these buildings," says he,[1] "was a marvellous one, whose entrance was from the exterior of the building by an arch 38 ft. wide. The same was made in such symmetry and capacity, that 6 men-at-arms with lance on thigh in front could ascend above the entire building."[2]

Note 1.p.308. Book I. Chap. 53.

Note 2.p.308. Evidently Rabelais in writing this had the memory of the general stairway in mind; yet it is surprising that he did not mention the double flight.

We have seen how Raymond du Temple arranged the grand stairway of the Louvre outside the buildings to as not to be restricted in the arrangement of the entrances, the passages of the flights and the landings. This method was also excellent and long persisted in the construction of the habitations of the lords; we see it adopted in the chateau of Gaillon (14). Here the principal stairway was placed at the reentrant angle formed by two porticos E and F. One can take the stairs by entering two external arches A, A, or by two arches B, B, opening from the portico, the first step being at D. This arrangement allowed in the upper stories one to enter the galleries by an opening pierced in the angle at G.[1] Such a stairway could not-

nowise restrict the enternal arrangements. At Plois we find a stairway independent of the building and placed at the middle of one of the wings instead of being erected in an angle. In his construction of the palace of the Tuileries, Philibert Delorme had still retained this tradition of the grand winding stairs of the middle ages, and his stairwan placed in the pavilion called the Horloge today, passed for a marvel of architecture, like that of Chambord. Further, the stairways of Gaillon, Blois, Chambord and the Tuileries were terminated by lanterns, which like that of the grand stairway of the Louvre, crowned the top and gave entrance on a terrace.[2] Although sometimes these screw stairs were inserted within the structure, but so that they retained their independent ascents. One finds that arrangement adopted in chateaus of the 15 th and beginning of the 16 th centuries. Then the winding stairs, instead of being outside the portico as at Gaillon, allowed the portico to pass before it. Fig. 15 presents the plan of the stairway established in that manner. A portico A B is placed in t the ground story before the occupied rooms. The stairway is recessed and square, its entrance at E and the first step at C. In the angles of the square trumpets extended to a spiral cornice and suppor the angle steps, which are longer than t the others. Thus the persons ascending or descending profit e entirely by the square enclosure, and yet the steps are all of the same length and are chamfered beneath, as if they swung a around the cylinder. The section of this stairway made on the line A B, Fig. 16, clearly indicates the arrangement of the flights, their balustrades, and the ends at the ground of the portico, at the mezzanine at G, and the second story at H. Th There exists a stairway arranged absolutely similar to this in the chateau of Chateaudun.[1] But in the winding stairway of chateaudun the angle trumpets extend from the square to the octagon, and corbels set in the angles of the octagon support the spiral cornice, whose horizontal projection being a perfect circle supports the ends of the steps. A view taken at the height of the first revolution of the stairway of Chateaudun, Fig. 17, where this revolution intersects the portico of the ground storw in its height, illustrates the arrangement of the trumpets, corbels, the spiral cornice and the steps chamfered beneath. This arrangement is further represented in horizontal

projection in the plan. (18.

Note 1.p.309. See Les plus excellents botiments de France, Du cerceau.

Note 2.p.309. At the poloce of Tuileries, the lantern crowed the dome flonked by four little lonterns in form of watchtowers.

Note 1.p.311. This choteau wos never finished, ond belongs to the duke de Luynes, the portion to which the stoirwoy pertoins dotes from the first yeors of the 16 th century.

The trumpets of the stairway of Chateaudun are jointed; they are flat arches slightly inclined toward the angle; this stairway was of sufficiently great diameter to require that jointing. In screw stairs of less extent, the corners extend from the square to the octagon and do not have so much importance: these angles only form a cut-off corner so as to give in horizontal projection an octagon with four large and four smaller sides. Then these trumpets or rather flats are cut from a single stone. The stairway of mansion de la Tremoille at Paris [1] gives in plan a square with a large cut-off angle; the three angles remaining in the interior beneath the steps were finished with little pendentives cut in a single sculptured stone. We give in Fig. 19 one of these pendentives. In these angles were placed the torches intended to light the steps. These t torches were either placed on little corbels, sometimes in l little niches, or were fixed to the walls as arms.

Note 1.p.312. Demolished in 1840; some frogments of thot m monsion ore deposited ot the Ecole des Beoux Arts.

The texts previously cited indicate how much in habitations of nobles, men adhered to giving (at least from the 14 th century) an appearance of luxury to grand stairways. The architects displayed the resources of their imaginations in the vaults covering them, and in the design of the newels. There e exist still in palaces in Rue du Petit-Lion-S. Sauveur a great tower, that formerly belonged to the mansion that the dukes of Bungundy possessed in Rue Pavee-S-Sauveur. This tower is built on a rectangular plan and crowned by machicolations, contains a beautiful winding stairway closed at top by a vault springing from the newel; the ribs of this vault are pointed arches and represent the oak limbs from which extend leafy branches under the vaults.[1] The newels of the primitive screw stairs,

either supported a spiral vault (Fig. 7), or formed a sort of [illegible] (Fig. 9), [illegible] even to these stairways, it was no longer possible to include the newel in the steps; the newels were enlarged to avoid the narrowness of the steps near the centre, and they were enlarged in this newel built in courses, or indeed also the newel was composed of large stones set on edge, as done for the posts of screw stairs in carpentry. When these newels were inclosed by [illegible] sculptures, that were sometimes perforated, and where the stonecutters had opportunity to make proof of science. In these newels supported hand-rails cut in the mass of projections in form of spiral bands to receive the small ends of the steps.

Note [illegible]. See in [illegible] archeologique de Paris, [illegible] de [illegible], [illegible], p. [illegible], a description of that tower and a plan of the stairway.

The newel of the stairway of [illegible] given in Fig. 17, is composed of very delicate ornament. It is constructed in [illegible] courses. We give in Fig. 20 a portion of it. At A is the hand-rail and at B a band receiving the steps, whose insertion is indicated in our drawing. The newel of the stairway of [illegible] is [illegible] was made of three blocks of stone from top to bottom and set on end and covered by sculptures, leaving [illegible] in recesses the ends of the steps.[2] The superposed blocks of that stone were connected together by [illegible] of [illegible] wood. [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] a very remarkable [illegible] and [illegible] [illegible].

Note [illegible]. [illegible] [illegible] [illegible] [illegible] newel [illegible] [illegible] the [illegible] [illegible] [illegible].

[illegible] after the [illegible] century, when one had only a [illegible] [illegible] for developing internal screw stairs, it entirely [illegible] newel to leave room for those [illegible] [illegible]. The steps were then simply supported in a [illegible], each having a round at the end near the centre to offer a hand-rail; in the place of the newel was a well-hole. Here (Fig. [illegible]) at A is the half plan of a screw stairs of that kind, at B its section on the line C D, and at E one of the steps in perspective, with the upper surfaces of the lower bed indicated by dotted lines. It also occurs that in the interiors of

eitner supported a spiral vault (Fig. 7), or formed a part of tne step themselves (Fig. 9). When a greater diameter was given to these stairways, it was no longer posseble to include the newel in the step; the newels were enlarged to avoid the narrowness of the steps near the centre, and they were engaged in this newel built in courses, or indeed also the newel was composed of large stones set on edge, as done for the posts of screw stairs in carpentry. Then these newels were inriched by delicate sculptures, that were sometimes perforated, and where the stonecutters had opportunity to make proof of science. Th These newels supported hand-rails cut in the mass of projections in form of spiral bands to receive the small ends of the steps.

Note 1.p.313. See in Itineroire orchoeologique de Poris, by M. de Guilhem, 1855, p. 299, o description of thot tower ond o view of the stoirwoy.

The newel of the stairway of Chateaudun given in Fig. 17, i is covered by very delicate ornament, it is constructed in hi high courses; we give in Fig. 20 a portion of it. At A is the hand-rail and at B a band receiving the steps, whose insertion is indicated in our drawing. The newel of the stairway of mansion de la Tremoille was made of three blocks of stone from top to bottom and set on end and covered by sculptures, likewise receiving in recesses the ends of the steps.[2] The superposed blocks of that stone tree were connected together by strong pins of hard wood. Unnecessary to state that the cutting of such newels before setting must require a very remarkable skill and knowledge of drawing.

Note 2.p.313. Important fragments of this newel exist at t the Ecole des Beaux Arts.

Sometimes ofter the 14 th century, when one hod only o very smoll oreo for developing internol screw stoirs, he entirely suppressed the newel to leave more space for those ascending or descending. The steps were then simply superposed in a spiral, each having a round at the end near the centre to offer a hand-rail; in the place of the newel was a well-hole. Here (21) at A is the half plan of a screw stairs of that kind, at B its section on the line C D, and at C one of the steps in perspective, with the unseen surfaces of the lower bed indicated by dotted lines. It also occurs that in the interiors of

apartments and to communicate from one story to another, stairs were built receiving light from the halls, screw stairs enclosed partly or entirely by tracery. There exist two charming stairs of this kind, which date from the beginning of th the 13 th century, in the two halls of the second story of t the towers of Notre Dame of Paris. We do not think it necessary to give them here, for they have already been engraved se several tomes and are perfectly known. One of these screw stairs is enclosed by columns in the cathedral of Mentz, that d dates from the middle of the 13 th century; we give (22) half its plan and an entire rewolution.[1] Aside from the circular wall that only ascends to the level A, the construction only consists of steps bearing the newel and the little columns of equal height, each supporting the outer end of a step. Nothing is more simple and more elegant than this little structure. Stairs of this kind are also seen in the upper part of the to towers of the cathedrals of Laon and of Rheims. These screw st irs rise in the middle of great pinnacles, that from the last story of the facade form at the four angles of the towers an open decoration for their entire height. The screw stairs of the cathedral of Rheims have in particular, that three steps are cut in a single course (the materials with which t this monument was erected are enormous), and that the outer e ends of these steps are relieved by blocks of stone set on e edge. Each block is then cut according to the prespective sketch, Fig. 23. Struts of stone B support the points A and then rest on the ends of the steps at C. In fact the newel D supports the entire load, and the stones B are only a series of p pillars forming an open enclosure. It also occurs that these screw stairs are half engaged in the wall, half open; thus w was arranged most of the internal stairs connecting two superposed rooms. The stairs of the gallery of church S. Maclou of Rouen (16 th century), that of the choir of the cathedral of Moulins (15 th century), furnish very pretty examples od this kind of screw stairs receiving light from interiirs.

Note 1.p.316. This stairs formerly ascended above the enclosure of the choir.

We have seen how the steps of screw stairs naturally form a rampant ceiling under the steps; how these steps are beveled or simply chamfered, or even left with square angles, thus gi-

giving as a ceiling the counterpart of the steps. But it occurred that one was sometimes compelled to establish straight or circular flights through massive constructions in castles and towers. The coverings of these flights then had to carry a considerable weight. If the flights were wide (as generally descents tc cellars in castles), the architects dared to cover t these stairs by rampant ceilings composed of a series of lintels, for fear of rupture. They what should they do? They turned a series of pointed arches A or round arches A′ beside e each other (24), but following the inclination of the steps a as indicated by the section C. These arches all had their springings at the same face; thew were all cut to the same curve. If the intrados of their imposts died at the face of the wall, the extrados reached G. These imposts were then equally seated, and the stonecutters or setters avoided the difficulties of cutting and setting rampant vaults, whose imposts take long to draw, occasion considerable removal of stone and require particular care in setting. If these flights through the constructions were narrow, if the architects possessed strong stone, they contented themselves by placing beside each other according to the inclination of the flights a series of lintels relieved by corbels at the sides (Fig. 24; elevation at D and section E). These very simple constructions produce a good effect and have a solid and resistant appearance; they perfectly indicate their destination and can be employed with inpunity under considerable loads. Vaults turned in offsets under great walls or masses do not have the inconvenience of causing the upper constriction to slip, as may occur when rampant tunnel vaults are established under these loads. Sometimes in fl- flights covered by lintels, instead of simple corbels placed under each lintel, a wide continuous moulding projects squarely beneath the stones forming the covering as indicated in Fig. 25. Of a necessity of construction these architects have made here a motive of decoration, as everywhere.

ESCALIERS DE CHARPENTE ET DE MENUISERIE.

Stairways of Carpentry and Joinery.

Of wooden stairs preceding the 16 th century, there remain to us only very few fragments. The oldest are perhaps the two screw stairs of the S. Chapelle of Paris;[1] it is true that th these are masterpieces of joinery of the 13 th century. Yet t

the architects of the middle ages carried very far the art of arranging wooden stairs in buildings, and in that their subtlety must have come to their aid, for of all parts of the construction of edifices or of private houses, the stairs is that requiring most skill and study, especially as often happens in cities and even in the habitations of the lords in the middle ages, when space was lacking. Thus one can recognize in examining the interiors of castles and houses, the architects made wooden stairs with one, two or four newels, and double flights; they even went so far as to build screw stairs of wood turning about a pivoted post, so as to reach at once all the doors of the apartments of the upper stories. In his Theatre de l'Art du Charpentier, Mathurin Jousse (1627) has preserved for us some of those methods still used in his time.[2] "No one is ignorant," says the author,[3] "that among all the work of the c carpentry of the building, the stairs does not yield in convenience and utility tn any other; being a passage, it is of common use and service for all chambers, stories and the e entire edifice; if it be useful, it is no less pleasing, but is also difficult in drawing sections aud assemblage, as well as for the variety found in them; for beside the ordinary ones common to all chambers of a building, there are some (although they are common), that still nave such a peculiarity, that two persons of two different apartments or chambers maw ascend without seeing each other; thus a single one will perform the functions of two, and will be common without so being. Some are made in other ways, no less pleasing than the former; for being built on a pivot, they are easily turned, so that by a half turn, they close all the chambers of a house, and prevent passage to places to which they previously afforded it."

Note 1.p.320. A single one of these stairs is old, the second has been rebuilt exactly on the model of that existing at the moment when the work of restoration was undertaken.

Note 2.p.320. We have already stated many times, that the R Renaissance in France was scarcely more than a new dress by which architecture was covered; the constructor remained French until the middle of the 17 th century, retained and reproduced his old methods, much superior to those adopted from t that epoch till the end of the last century.

Note 3. p.320. Fig. 118. p. 155.

Before presenting some examples of stairs in carpentry or joinery, it is necessary to first indicate the elements composing these stairs. There are stairs with straight strings w with posts, stairs with newels, and screw stairs without newels and with spiral strings. In the wooden stairs of the middle ages the steps are always solid, attached to the strings by tenons and mortises.

Let (26) be a straight string with inner face shown at A a and section at B; each step will have a tenon C with tusk D, and will be slightly housed at E into the string. These steps will be beveled underneath and form a rampant ceiling. The s string will also carry the balusters G, tenoned and morttses cut in the notches H. The ends of the step with its tenon is sketched at K. These steps being solid are usually cut from logs as indicated by the sketch L. Three saw cuts I divide each log of 1.6 ft. diameter into six triangular prisms, in each of which is formed a sted, so that the tread of each step may be in the heart wood, the tread of the step being th the part most worn. If there remains some part of the sap-wood on the surface, this is found at the rear of the tread which not subject to the friction of the feet. This method of making the steps of solid wood, the tread next the heart, further has the advantage of preventing the wood from cracking or warping, the saw cuts being made exactly in the direction of the cracks. This diagonal sawing of the steps loses none of the solid and resistant parts of the wood, the steps are all in the same conditions of hardness, and there remain at M good slabs that can be utilized elsewhere. One recognizes that the constructors have selected their wood with great care for the strings and steps, to avoid dislocations and the warping so injurious in works of that nature. Sometimes, but rarely, the steps are of walnut or chestnut.[1]

Note 1.p.322. Particularly in the centre of France.

These first principles of construction being stated, let us first examine a stairway in two flights witt steps at the landings, straight strings and angle posts; this is the simplest carpentry stairs, that constructed by the most natural means. Here at A, Fig. 27, is the plan of a stairs established on th this system; the first step is at B, one arrives at the first landing C, takes the second flight whose step is at D, ascends

of the landing E, which is at the level of the second story, and thus for each story. The scale of the plan is 1 : 100. Let us make a longitudinal section on a b at double size for clearness. Its four angle posts rise from the ground and are set on a stone coping. The first string also rests on that course and joins the post F into which is halved the landing step G, again supported by a timber attached by tenons and mortises, resting on the bracket H. Pass to the third flight that is entirely similar to the second, and which is represented in the section. The string is relieved below by the brace I and the tie K. The large ties are especially necessary to prevent swaying and thrusts, that do not fail to occur in stairs of this kind serving several stories; they stiffen the entire system of carpentry, especially if as drawn, the open panel is placed in the triangle formed by the post, string and that tie. The balusther of the railing are fixed in the strings, a and their hand-rails in the posts.

Let us now examine how are combined the joints of the strings with the posts, the landing steps, the beams of the landings, etc., Fig. 28; at A we have drawn in the same view the post, the landing step, the upper step and the starting step (this is the detail of the part L, Fig. 28); at B is drawn the post; at C the beam of the landing with its double tenon and its moulding at C′; at D the brace of the starting string, at E E′ the ending of the string, at F F′ the starting string with its tenon; at G the last step forming the landing step; at H′ the first starting step resting on the landing step with its tenon I entering the post; at K is part of the landing step seen in section between the two posts. This landing step, halved into the post and partly resting on the beam C, is strongly fastened at its junction by means of a bolt passed through the brace D. The posts are 7 ins. by 8 ins. deep in the direction of the flight. The brace D of the strings E E′, F F′, is not joined at the middle of the posts; these strings are 6 ins. thick and are flush with the outside of the posts (see plan). Observe the various joints made in the post traced in the perspective detail O; at N is the bracket designed to receive t the landing beam C; at P are the two mortises and housing of the joint of that beam; at R is the gain in which rests the landing step with the hole S for the bolt; at T is the brace.

The perspective sketch Q shows us the landing step on the side of its gains entering those at R on the post. The last upper step is represented at U; the first starting step atV with i its tusk and tenon X; one sees at Y the hole for the passage of the bolt. This system of stairs vit straight flights and landings continued until the 17 th century. it was very stable, could not be deformed like most of our stairs, whose strings are only fastened to the landing steps and always end in bending. This is true carpentry in which all joints are visible and solid, and alone form the decoration. Further, nothing prevents covering the posts, stringr, ties and balustrades by carvings and paintings; then this is often done.

Screw stairs were built of wood as well as of stone. The o oldest were constructed in the same manner, i.e., the steps were solid, superposed and supported the newel. Double strings were made, that might have two flights, as we have said above, i.e.,(29) that entering indifferently by either door C or C′, one took either flight with its first step A. This was a means of giving entrance into rooms of the upper stories by doors opened over those at C, C′. The person entering by the door C could rejoin the one entering at C′, the two flights circling around each other. The two newels were connected by two strings B crossing each other. These stairs were very common during the middle ages and until the 17 th century, were convenient, and it is not explained why their use ceased. At one end the steps tapered or uniform, were connected with the two newels and the str ngs by tenon and mortise; at the other they were engaged in the masonry or rested on a strip of wood nailed along the half timber frame.

But frequently screw stairs of wood were entirely isolated, forming a work independent of the building. These stairs placed in communication two stories, and they were set in the corner of the room to communicated only with that above. This was rather a work of joinery than of carpentry, treated with care and frequently with great richness of mouldings and of carving. Yet the steps of those stairs of joinery remained solid until during the 15 th century, supported newels, aod were connected at the centre by means of a round iron rod or bolt, that prevented them from moving. Each step had its vertical strut to which it was connected (30). These verticals were each of a

single fiece for each story, were fixed at bottom to the floor of carpentry and at the top to a circle also of carpentry. This formed a cylindrical enclosure or a prism with as many sides as there were steps in the horizontal projection. We g give at A the quarter plan of a stairs of this kind having 12 steps around its perimeter. The verticals are at B, and the newel rests on each step at C. The spaces E F give the overlapping of the steps on each other, the front of each step being F and the back at E. If we make an elevation of the quarter circumference of the stairs, we obtain the vertical projection G. There is seen at I the bolt that passes through the course of the newal belonging to each step. The ends of the steps appear at K and rest on a bracket notched into the vertical. The detail O gives the horizontal section of a vertical at one-tenth full size. At a is the tenon of the end of the s step indicated at a′ in the perspective sketch M; at b is the tenon at the end of the bracket, its tenon is indicated at b′ on the perspective sketch N; the back of the step being at e, the face of the next step above is at f. Each step resting on the rear of the one below bearing the tenon a, has no need of a tenon on the front, the more that these steps fully rest on the bracket J, furnished with a projection P intended to hol d their ends T. A gain R made in the vertical R also further permits the step to be fixed into that verticala The perspective sketch M shows the front of the step coved at S, the end being visible outside at T, the two gains allowing the verticals to pass and gained at Q, the boxing of the end of the bracket u under the end of the taper of the back at V, made for space a and lightness. According to this principle are constructed t the two stairs of the sanctuary of the S. Chapelle of the palace (13 th century), and some stairs of towers, notably that of the tower S. Romain at Rouen (15 th century). Two of the verticals cut off at 6.6 ft. from the ground and resting on a cross-piece attached to the adjacent posts, permit the entrance into these enclosures and to take the stairs. It is clear that one could decorate the verticals by capitals and mouldings, and that the brackets could be very rich, and the ends of the steps be moulded. Exceft the axial bolt, these stairs were built and maintained without the aid of iron work; this was a work of joinery, without the use of other means

than those suited to this art, so ingenious when it adhered to the methods and procedures that belonged to it.

About the beginning of the 15 th century, in the construction of screw stairs in carpentry and joinery, men ceased to c cause each step to carry a part of the newel. That wes erected in a single piece, and the steps were joined to it by a series of mortises cut one above another according to the flight. This was done at the same epoch for screw stairs in stone, as we have seen above. Just as the stone newels were carved, as they were cut wit continuous lines, the corbels were arranged to receive the small ends of the steps, similarly were made newels in carpentry. We saw demolished the old college of Montaigne at Paris and a pretty screw stairs in joinery, whose n newel was a long timber 39 to 43. ft. in height, and very skilfully worked like a column with spiral ribs, corbels under the steps and a hand-rail. We give (31) the arrangement of these carpentry newels at the junction of the steps. At A is seen the mortises of each step with the shoulder below to relieve the span; at C is the hand-rail cut in the solid like the corbels; its profile is traced at D, cut perpendicular to its inclination, the profile of the cornice with the corbels is traced at E.

Before ending this Article, let us say a word on those pivoted stairs of which Mathurin Jousse speaks, and that must have been employed in buildings where night surprises were to be feared, in manors and keeps. These stairs were established in a round tower, in a cylinder of masonry pierced by doors at the heights of the stories, that one desired to reach. The stairs was independent of the masonry, and was composed of a an axis or pivoted newel supporting the entire system of the carpentry. The plan of that stairs is shown at A and its section at B. At each story to which it was necessary to afford access, was arranged a landing C in the masonry. We arsuem all the doors to be opened over that of D of the ground story. T The first step is at E; from E to F the steps are fixed and independent of the carpentrw newel mounted on a lower iron pivot G, and maintained at the top of the screw in a circle cut out of two horizontal pieces of wood. The first step is fixed to the newel at H; it is strongly supported with the three succeeding ones by braces I. From that supported step H begins a

spiral string fastened to the ends of the steps, and supporting a cylindrical enclosure of wood pierced by doors opposite the openings D in the masonry. Above the third step (starting from H), the other steps up to the top of the screw are only supported by the little braces K, shorter than at I, so as to facilitate the headroom. Thus all the steps, the string and the cylindrical enclosure rest on the pivoted axis O. When it is desired to close at one turn all the doors of the stories, it suffices to turn the cylinder a quarter turn on its axis. These doorways are then covered; between the steps F and H remains an interval, and persons that have ascended it to enter the apartments, finding a wall opposite the openings found in the cylinder, and are unable to guess the location of the actual doorways corresponding to those openings, when the stairs is returned to place. A simple bolt shot by the occupants on one of the landings C prevents rotation of the screw. There was a means of avoiding intruders. We have sometimes found c cylindrical enclosures of masonry in castles with doors at e each story, without any trace of the stairs of stone or wood; it is probable that these enclosures contained stairs of this kind, and we believe this invention to be very ancient; it is certain that it could be utilized, when it is necessary to reach several points of the circumference of a circle at the same level. We shall have occasion to speak of these stairs in Arts. Chateau, Maison, Manoir, Palais.

ESCHIF. Bay. Turret.

A little flanking fortification made to defend the approaches to a gate or to enfilade a trench, when the enclosures of cities consisted of a simple walla Frequently these bays were wooden structures,temporary if time and resources are wanting for erecting towers. Lebeuf, in his Histoire de la ville d'Auxerre,[1] says that at the end of the 14 th century, there were erected several bays."They removed at certain places and rebuilt at others; then was given the form of actual towers to what was previously only a simple bay; in brief, the city was fortified in proportion to the entrance tax granted by kings Charles V and VI." After a siege during which the walls were damaged and their towers dismantled, bays (1) were placed on the curtains to command the exteriors, during which were exec-

executed the repairs judged to be necessary. [1]

Note 1.p.331. Mem. conc. l'hist. civ. et eccles. d'Auxerre, b: abbe Lebeuf, pub. by Cnelle and Quantin. Auxerre. 1845. Vol. III. p. 279.

Note x. p. 332. Of the old fortifications of Blois. Civil. orbis terrorum. 1574.

ESCOPERCHE. Scaffold Pole. Extension.

A pole or timber set vertically to support the putlogs of a mason's scaffold (Art. Echafaud). It is also a timber with a putlog at its upper end and attached at the top of a crane to increase its height and give it greater reach.

ESTACHES. A Retreat or an Assemblage.

Used in the plural and during the middle ages signified an assemblage of pious persons. (Art. Cloture).

ETAI. Shore. Strut.

A straight and stiff timber employed to support a structure that threatens to fall. One cannot doubt that after the 13 th century architects were very skilful in the art of shoring st-structurer, either to strengthen them by means of underpinning, or to modify the previous arrangegents. The facility with which the decided seems prodigious, at the moment when Gothic a architecture appeared, to change and partly rebuild scarcely completed buildings in order to put them in harmony with the new methods, which rapidly advanced, and cannot only be compared to what we see done in our time.

Since the architects of that epoch of the middle ages worked on generally light structures, in which one never finds an excess of strength, it was necessary that their procedures in shoring should be very perfect, for those heavy structures, kept in equilibrium by forces acting in opposed directions, could not be maintained when a part was removed, and it was to be feared in certain cases, that the shores should not have sufficient force to thrust sufficiently and destroy the e equilibrium of structores, that it was claimed to preserve. On seeing the nature of the underpinnings executed by the constructors of the middle ages, one cannot doubt that they very frequently employed struts, a sort of shore that supports ver-

vertically without exerting either thrust or pressure. Thus the underpinnings made about the middle of the 13 th century in the choir of S. Denis, and those much bolder made at the end of the century in the choir of the cathedral of Beauvais; about the the beginning of the 14 th century in the side aisles of the choir of Notre Dame of Paris near the crossing, and in the cathedrals of Nevers and of Meaux, indicate boldness a and singular skill. It would be impossible for us to furnish examples of all the cases of shoring that might be presented; the skill, knowledge and experience of the constructor can o only prescribe to him the system of shoring required by each particular case. We shall refrain from prescribing methods g good in one case and bad in another; we shall content ourselves by indicating general principles. Thus when one shores a particular part of an edifice, he should not think only of p preventing the effects of a dangerous movement produced in t the structure, but it is necessary to make such arrangements,, that the part to be replaced being removed, the loads or thrusts cannot act in the sense contrary to the effect produced; it is essential for all shoring to be neutral.

For example, if we rebuild the piers of a nave in which the effect is produced, as indicated in Fig. 1, shoring A B is e excellent to stop the bending of the piers C D, but will be dangerous if we remove the column D E to replace it by another, for the loads acting from C to E cause the shore A B to pivot on its base G and to firce the arch I K to I'K, which will produce a dislocation of the entire structure and a settlement of the upper parts. In this case one must be very c careful to do nothing that can charge the bending between B and E. One must be contented with placing a frame of shores L M, Fig. 1 bis, and nothing at each side of the pier to be removed from N O, the lateral arches being round; then one can remove the pier and rebuilt it vertically while transferring its base to R'. When it is necessary to shore a wall behind which are built vaults, to rebuild it entirely or in part, Fig. 2, the first operation to be done is to place centers u under the arches A B of the vault; as for setting the external shores, their heads should bear exactly above the point of support where the rupture is particularly apparent. If the rup- rupture of the wall or buttress is at C, the head of the shore

should bear at D, and to receive that head, it is prudent to first insert in the masonry a good block of hard stone, so t that these may not rest on that head or crumbling or weakened surface, or without bonding to the wall. Let -, Fig. 2 bis, be the old surface, a strong block B of hard stone is first inserted to project from the face, and placing under it a good wedge of heart of oak, below it is set the head of the shore D. It is unnecessary to state that the architect must pay the greatest attention in all cases to the ground or sill on which rests the base receiving the foot of the shore; too frequently one neglects to be sure of the resistant quality of these points of support, it results that the shores sink their sills under the load. These sills must be placed on uniform ground; they should be large and thick, well wedged at the desired inclination, and set in good plaster underneath. At Paris, t the custom in building very large structures, of underpinning very high and very heavy houses, causes shoring generally with skill and stability, but in the provinces our architects and contractors do not devote the required attention and care, t in these delicate operations.

The best wood for making shores is evidently spruce, because it is straight and extremely stiff; it is difficult to make good shores of oak, generally of moderate length, often crooked and heavy, and consequently more difficult to raise. However in shoring, oak must be preferred for sills, wedges and the caps of shores, because its wood does not crush under the load like that of fir. Poplar is employed in some parts of France for shores, but is much too flexible timber; it bends and twists in all directions under the load, however well it may be braced.

To obtain a simple shoring of great strength, one should never trust to a single spruce timber, however large and sound it may be; it is necessary to double the shore, i.e., to place two shores in the same plane perpendicular to the face of the wall or pier to be shored, and to brace between these two shores. A powerful shore is that in Fig. 3, and two or three timbers set in the same plane must not be parallel; they must form a trangle or a portion of a triangle, because a triangle cannot be deformed; being braced, the timbers not being parallel present a homogeneous whole, like an enormous

brace; while if parallel, they can bend under the load, as demonstrated in Fig. 3 bis, however well braced. It is not indifferent whether the shores are closer at top or bottom. If (Fig. 3) a wall A B presents an abrupt bend at C, the shores should be set as indicated by the sketch D, i.e., the two timbers w will be farther apart at their feet than their tops, for the bending being at C, it is necessary to support and abut the upper part k, and it would be dangerous to produce a pressure from the exterior to the interior at E, which would infallibly occur if the large shore G H received the load; then one would risk increasing the rupture of the masonry above the bend. But if a wall is bent in a uniform manner, as indicated by the s sketch F, the two shores should be more distant at their tops than their base, for if the masonry rests on the upper timber G′H′, and this timber receives the load, all the load and the thrust from inside to outside will be transferred to the second timber I K; it is then necessary for this not only to support, but also to abut by its inclination the bending, that would tend to increase at K.

It it is necessary to place double or even triple timbers i on a plane perpendicular to the wall to be shored, when one desires to obtain great strength, and to prevent the timbers from bending in their plane, it is also necessary to prevent them from bending out of the proper plane and warping; to do this it is well to place groups of shores as indicated by F Fig. 4 in plan and perspective; these two non-parallel groups must be made stable by braces. Thus by arrangement of the shores, the system will only form a stable and very resistant body represented by the sketch O, a sort of buttress in a single piece, beiug unable to slip or be deformed. This sort of shores is very good to maintain a retaining wall pushed by earth, and that threatens to yield to a very strong pressure.

Nothing is more satisfactory to the eye than shoring well combined and executed. Every architect that loves his art should not only indicate the arrangement of the shoring, he must also supervise very carefully that the carpenter employs timbers proportioned in strength to their purposes; that these be clear and properly cut as required; that the braces be gained and cut to length, neither too thick nor too thin; that the bases present under the feet of the shores a plane and

smooth surface

smooth surface, cut as far as possible to keep the shores in their plane; that the wedges are properly cut and are of good wood, the spikes or nails that hold them being driven straight; that the masonry under the bases be made with care, regularly extending on each side the breadth of the base.

There are circumstances in which one can neither place props, ordinary shores or struts, for example, where it is necessary to remove a pier underneath, because the lower courses are c cracked or seriously injured. Let Fig. 5 be a cylindrical pier supporting arches in all directions, four transverse and four diagonal arches; this pier supports two or three stories and other piers with vaults; it is impossible either to shore it or to establish props. The eight arches may have centerings, but that will not prevent the weight of the upper pier from acting on the lower one. The lower courses of that pier are crushed. We shall establish an oak frame of large timbers, t that will be as indicated by sketch B in perspective and B′ in plan, with joints, tenons and mortises, bolts b and keys e, which permit drawing the fram strongly against the cylinder. This frame will enclose the cylindrical pier beneath the astragal of the capital; (see sketch D); we shall fill with good plaster the entire interwal between the top of the frame C and the corners of the abacus E of the capital. Under the angles of the frame we shall place eight struts G, also indicated at G′ in sketch B, sufficiently inclined to allow us to pass in the courses that replace H. But under the capital exists one or two drums intact, that are to be preserved. We h have made four iron straps according to sketch F, of the height of the drums to be retained; these straps are to be fixed with square head screws and gained on the frame; their ends I will catch the lower bed of the drum to be retained. This being done, we can remove the course K from the mass with the point, then remove the lower drums and replace them with new stones. If the entire lower pier be crushed, if its capital is broken, if the imposts of the arches are bad, we shall proceed in the same manner for the capital of the column above it, Fig. 6; we pass the eight struts through the eight compartments of the vaults (see plan M) at P, and we then have our iron straps extend to the defective point, as at O, and we reremove all the lower part and rebuild and underpin; removing the vaults (once the upper pier is shored), we

the vaults (once the upper pier is shored), we first rebuild the lower pier with its imposts and arches, and that being c completed, the struts and frame are removed, resting the vaults on centerings without trouble.

If one can trust the solidity of the capitals or if the piers have none, if these capitals themselves are to be replaced because they are broken, one can have recourse to frames with iron caps.

For example, it occurs that the piers (7) receiving two archivolts A, two diagonal arches B and one transverse arch C, a also at D the load of the upper pier supporting the high vaults, are too small, are broken, or are crushed as far as the tops of the imposts of the arches. In this case, to rebuild these piers, their capitals and their imposts, it is not only necessary to shore the upper construction; it is also essential that these shores permit the passing of great blocks between them, and to bring them to their places without too much difficulty, set them properly and fasten them well. Shoring is nothing but to shore in the manner to allow rebuilding between the struts is frequently the problem difficult to solve.

Then let E′ be the elevation of the pier E; not only is that pier bad, but the imposts of the arches are broken as far as F. Above that level the masonry is thicker and is retained; it is necessary to remove the entire construction between F and G. First we place a center under the transverse arch C, t two centers under the two diagonal arches B, then in Fig. 7 b bis we place under the two archivolts A two shores arranged as our sketch indicates; at H H we place two ordinary struts to maintain well the front of the pier, we remove the first voussoirs of the archivolts from I to K; which will permit us to make two holes L through the masonry retained in order to pass two strong iron beams M, each composed of four bars banded together, with strength proportioned to the load. These two beams rest on the frame N supporting oak caps O. In plan this shoring presents the horizontal projection drawn at P; the pier is E″, the centres are C′B′B′, the shores of the archivolts are A′, the frames are N′ with their caps O′. The iron beams are shown by two black lines. The shores of the front opposed to the thrusts are projected at H′. These must be combined and placed, so that at the height of the capitals, abacuses a

and imposts, courses that we assume in two blocks for each, the space S T between the shores A′ and the feet of the shores N′, being wide enough to pass these blocks. It is also necessary that the cap of the rear frame clears the transverse arch C, to not interfere with replacing the first voussoirs of that arch, if needed. The courses resting thereon must be strongly wedged under the masonry V. The voussoirs being well set and fixed above the imposts, the two iron beams L are removed, a and the small holes left are filled. The frames and iron bars being first removed, the shores of the archivolts are taken away, and only after the mortar is fully dried, the two struts H. It is understood that the order in which the shores must be removed is not an indifferent matter, for if these shores fulfil their functions well (and in such a case, it is necessary for them to do this, since they alone bear all the load), when the removals beneath are completed, however well this is done, it is always the shores that support. From the moment that these are loosened, the new construction assumes the load; it is then important:- 1, that they only take the load gradually; 2, that the loads act equally and vertically on t them. Frequently a shore is loosened too soon or too rapidly, and causes the breaking of the best established substructures. The important thing is to loosen together the opposite shores, as for example, the two shores A of the archivolts. Further, it is with shores as with many other matters that belong to t the art of construction; so many examples, just as many special cases; consequently as many procedures applicable to these particular cases. One can only establish the general principles and indicate some of the thousand applications presenting themselves daily. We will state that the first care of an architect, that desires to shore his structures, is to know exactly how they are to be made, what were the procedures employed by the constructors, what were their habits, their machines, their d defects and their ordinary qualities, for one must in advance guard against these defects anf profit by these qualities.

The edifices of the Gothic period being elastic and always equilibrated, it occurs that these properties can serve you, if you know them accurately, or they may cause accidents if you do not take them into account. We have seen underpinned structures, that because of their height and enormous weight

could not be shored, for example, towers placed on four piers, and that by very simple and inexpensive means, because the constructors directing this rebuilding knew how to profit by the flexibility of these structures, and utilized the conditions of equilibrium. But when one underpins, by the extraordinary means employed it costs more than the entire construction of the part of the monument to be strengthened, that is no longer art. let us again state that every building shored to be repaired requires constant supervision. The architect must observe the least symptoms manifested; the opening of a hole, a cr crack in a stone, are always the indication of a movement, t that however weak it may be, must be ascertained, and the architect should allow himself no rest, till he has recognized the cause to remedy it. A wedge properly placed, a strut set in time, often prevent the most serious accidents. if movements appear, it is at least necessary that they come to the a aid of the architect, so to speak, that they enter into his general system of support. It is the same for those very serious cases, where the architect must produce these movements, like a skilful physician, to treat a local information, to dr draw the disease to a different part of the body. One may say that all shoring of structures consists in preventing an evil; but in Gothic edifices, it is not sufficient to prevent, it is necessary to avoid that evil; if a point weakens, all the vertical or oblique loads rest on that weak part; it is then necessary to reestablish those laws of equilibrium, and for that it is not only necessary to support and restore the part injured, but it essential to transfer the excessive loads elsewhere; otherwise, the repairs being made, equilibrium will always be broken, and the evil remedied at one point will soon be produced elsewhere.

ETANCHON. Strut. Shore. Stanchion.

A timber set vertically under a structure to stop crushing. The strut only resists vertically; it is generally short; when it execcds a length of 6.6 ft. to 9.8 ft, it genarally takes the name of shore.

During the middle ages by the same word was also designated the little posts that the miners set beneath undermined walls to prevent them from falling on the workers. When it was desired to cause the walls to fall, fire was set to the struts.

(Arts. Architecture Militaire; Siege).

ETAYEMENT. Shoring.

Also written etaiement, the action of shoring or combination of shores. (Art. Etai).

ETONNE. Stunned.

Men say; this iron or this stone is stunned, this signifies that the iron has suffered a shock or test, that not causing an immediate rupture, has however predisdosed the metal to b break easily; that the stone has likewise disintegrated by a physical force or cracked by a shock, and that it is also found in bad conditions for resistance. An unskilful smith may shock his iron if he gives it a false stroke of the hammer, when it commences to grow cold, the careless stonecutter shocks his block of stone in cutting it, for example, if he breaks o off a piece without taking time to remove the stone gradually. It stuns the surfaces to use a bush hammer, i.e., it disposes them to disintegrate more easily under the action of atmospheric agents. The architects of the middle ages, who did not desire hollows, took care to profile them in such manner, that the stonecutter was not led to stun the stone. Thus for example, the horizontal sections of piers composed of clusters of little columns, those of the moulded arches always in the reentrant angles having hollows or flat fillets, that stop the tool in time to prevent stunning the stone. If we profile a pier according to sketch A, Fig. 1, it is certain that to obtain the sharp angles B, the stonecutter will stun his block; but if we trace the section C, reserving the flat fillets D in these reentrant angles, we shall avoid this great inconvenience; although the stone is hollowed, it will retain its strength. (Art. Profil).

ETRESILLON. Strut.

A timber designed to prevent two parts of the structure from approaching each other. When a wall pierced by openings breaks or is dislocated, the first operation to perform is to strut the ofenings. (1). A are struts set between the bambs of the openings on vertical planks B.

In masonry the architects of the middle ages frequently ad-

adopted struts as a means of permanent construction, like the flying buttress, that may well pass for permanent struts. The south porch of the cathedral of Puy-en-Velay, built about 1150, presents a very singular example of the use of struts fixed in the masonry. This porch opens with a great archivolt possessing a concentric isolated arch (2), absolutely useless, and a pure decoration maintained by means of three isolated pilasters, intended to prevent its rising or its deviation from t the vertical plane. The section A made through the middle of the archivolt, indicates at B the lower detached arch and its little axial pilaster C. With more reason circular rose windows inscribed within curvilinear triaugles, are strutted in the two lower angles by little columns, that prevent the voussoirs from leaving the curve (3). This arrangement is seen to be adopted to maintain the voussoirs of the rose window opened over the lateral doorways of the facade of the cathedrad of Amiens. In fact the great rose windows of our French churches dating from the middle of the 13 th century, only consist of a system of stone struts. (Art. Rose).

ETUVE. Baths.

No one is so ignorant of the care with which the Romans established public and private baths. The ancients regarded hot and cold baths not only as one of the best means of preserving health; but also this was for them a custom, a pleasure. Our clubsin the great cities, and our cafes in small localities, are the only establishments today, that can give us the idea of what were the baths among the Romans. Men went to the baths to bathe, but still more to assemble, to know the news of the day, to speak of their business or pleasures. These habits th that belong to an advanced civilization must evidently be changed when the barbarians extended in the West. Yet if we believe Tacitus, the Germans rose late, bathed most frequeutly in warm water, after which they took some food.[1] Charlemagne seems to have adopted entirely in that respect the habits of the Romans. Eginhart[2] says that this prince greatly loved baths in thermal waters. "With a passion for swimming," he a adds, "Charles became so skilful in it, that no one could be compared to him. For this he had built a palace at Aix-la-Chapelle, and he lived there constantly during t e last years of

his life, until his death. He invited to bathe with him, not only his sons, but also his friends, the great men of his court, and sometimes even his soldiers and his lifeguards, so that frequently a hundred persons or more bathed at a time." It is not doubtful that Charlemagne in this as in many other things, only resumed the habits of the Romans of antiquity.

Note 1.p.347. Latin note.

Note 2.p.347. Vita Karoli imperator. Section 12.

Note 1.p.348. Roman de la Rose, verse 11,132 et seq.

Note 2.p.348. The same. Verse 17, 85, et seq.

No longer are found traces of these great arrangements from the 10 th century, and the baths after the 12 th century are only bathrooms, i.e., establishments similar to those that we still possess today, except that the bathtubs were of wood, marble or stone, and the bathrooms were probably less inconvenient than ours. It was also the custom during the 13 th century to bathe in company, sometimes even in the same tub. (Old French poem).

And all being well close, a good fire was kindled. (Old French poem).

It appears that then (in the 13 th century) there were bath roomsin the castles, but there existed much frequentel public baths in the cities. Indeed many old cities have retained their street of baths. In his excellent Histoire des Provins by M. Bourguelot [1] we read this passage:-- "As for baths, the f first mention that we find of them exists in a note of May, 1236, according to which Raoul de Brezelle, knight, gave to the poor of the hospital of Provins 12 deniers of rent, that he had received annually for five rooms located behind the hospital between the mint and the baths. It is probable that these baths, which occupied the location where one still sees the graceful mansion of the lions, being the only ones originally in Provins, that their age had given them the name of the old baths. They fell into ruin in 1356. Louis-le-Hutin established new ones in 1309 "because of the wealth of the people," says Moissant; [1] but the wealth was not of long duration, for we see sometime later "the rent of the baths diminishes in a sensible manner." [2]

Note 1. p. 348. Vol. I. p. 277, 1839.

Note 1.p.349. "In 1309 the baths were paved with stone from

Paris, and equipped with furnace, boilers and bathtubs."

Note 2.p.349. In 1311 the new baths rented for 240 livres; in 1315 at 100; in 1320 at 60; in 1325 at 95 livres.

These baths consisted only of rooms more or less spacious, and in which were placed tubs filled with warm water by means of pipes, as still practised today. In palaces bathrooms were o often very richly decorated. Sauval [3] relates that at mansion S. Pol and mansion of Petit-Muce, king Charles V had caused to be arranged for the queen bathrooms paved with lias stone, "closed by iron lattice doors, and surrounded by wainscot of Irish wood; the tubs were of the same wood, ornamented all around by gilded bosses, and fastened by rings attached by n nails of gilt copper."

Note 3.p.349. Hist. et Antiq. de la ville de Paris. Vol. II. p. 280.

After the 14 th century, the same author states elsewhere,[4] "our kings built baths at the point of the island (of the palace),[5] and for these caused to be built a structure named t the house of the baths, as much for them and their children, as for the princes and the other great lords lodged with them; for at that time there were not only such in all palaces and great mansions, but even in some streets of Paris, expressly intended for them; from which it comes that some still retain this name of Rue des Etuves. As for the baths of this island, they were were given by Henry II to the workmen of the mint, at the mill that he caused to be built at that place, but which was destroyed when the Pont-Neuf was undertaken."

Note 4. The same. Vol. I. p. 99.

Note 5. Toward the terrace of the Pont-Neuf.

In these private baths were washtubs, that served as bathtubs, and that were placed in a room when one desired to bathe; that was termed bringing the bath." He sometimes brought the baths and heated the baths." Even sometimes meals were taken in the baths; "sometimes going to the bath, before which a fine supper was laid and served in haste."[6] And elsewhere; "One day among others, Madame had wished to bathe herself, and she caused the bathtub to be brought to the bathroom to be heated in her mansion."[1] A great number of vignettes of manuscripts of the 14 th and 15 th centuries show us personages taking be baths in a sort of wooden washtubs placed in a chamber, Every-

one knows the date of the question, then define [illegible]
century, of all [illegible] [illegible], and so [illegible]
many others. If we did not fear to be too lengthy, one may c
conclude here: that during the middle ages the use of baths, as they are taken today, was very extensive; that there existed public bathing establishments, in which were found basins and [illegible] to [illegible]; that men [illegible] there and even passed the night; that in castles and great mansions there were halls intended for the baths, nearly always in the vicinity of the [illegible]; that the use of baths during the 16th and 17th centuries was much less extensive than it was before that epoch, and was almost exclusively by the elevated classes; [illegible] not present particular arrangements, only consisting of [illegible]ners in which were placed the tubs.

Note 2.p.350. See the extract given in Recueil de [illegible] des XII et XIII siècles. vol. III, p. 155.

Note 1.p.250. La Belle de l'[illegible] (cent nouvelles nouvelles).

[illegible]. [illegible]

The four evangelists, S. John, S. Matthew, S. Luke and S. [illegible], from the first centuries of the middle ages are represented either under the form of [illegible] [illegible] a book, or by the symbolical figures; S. Luke by the ox; S. [illegible]; S. John by the eagle; S. Mark by the lion. Sometimes the heads and the symbol are combined, and even the evangelists have the bodies of men with heads of the ox, man, eagle or lion. In [illegible] we have given examples of the [illegible] figures applied to the evangelists, and in [illegible] one can see the [illegible] seated on a [illegible] with four heads and four feet corresponding to the four symbols of the evangelists.

The sculptors and painters of the middle ages have also represented the four evangelists seated, or mounted on the shoulders of the four great prophets of the Old Testament. At the south portal of the cathedral of Chartres, beautiful sculptures of the 12th century show us the four evangelists so placed. (1). At Bamberg the evangelist holds the roll; he is mounted on the shoulders of the prophet to whom the artist has given the [illegible] of an [illegible]; the prophet [illegible]

one knows the tale of the washtub, that dates from the 12 th century. Of all preceding citations, and to which we could add many others, if we did not fear to be too lengthy, one may c conclude here; that during the middle ages the use of baths, as they are taken today, was very extensive; that there existed public bathing establishments, in which were found baths and all relating to the toilet; that men ate there and even passed the night; that in castles and great mansions there were halls intended for the baths, nearly always in the vicinity of bedrooms; that the use of baths during the 16 th and 17 th centuries was much less extensive than it was before t that epoch, and was almost exclusively by the elevated classes; that these public establishments during the middle ages did not present particular arrangements, only consisting of chambers in which were placed the tubs.

Note 2.p.350. See the extract given in Recueil de fabliaux des XII et XIII Siecles. Vol. III. p. 135.

Note 1.p.350. Le Peche de l'anneau.(cent nouvelles nouvelles).

EVANGELISTES. Evangelists.

The four evangelists, S. Luke, S. Matthew, S. John and S. Mark, from the first centuries of the middle ages are represented either under the form of clothed men holding a book, or by some symbolical figures; S. Luke by the ox; S. Matthew by the man; S. John by the eagle; S. Mark by the lion. Sometimes the personnage and the symbol are combined, and even the evangelists have the bodies of men with heads of the ox, man, eagle or lion. In Art. Animaux we have given examples of the symbolical figures applied to the evangelists, and in Art. Eglise personified, one can see the New Law seated on a beast with four heads and four feet appertaining to the four symbols of the evangelists.

The sculptors and painters of the middle ages have also represented the four evangelists seated, or mounted on the shoulders of the four great prophets od the Old Testament. At the North portal of the cathedral of Bamberg, beautiful sculptures of the 12 th century show us the four evangelists so placed. (1). At Bamberg the evangelist holds the roll; he is mounted on the shoulders of the prophet to whom the artist has given the pose of an acrobat; the prophet turns his face toward the

evangelist, the latter has

evangelist; the latter has the halo. A dove (the Holy Spirit) is placed on the capital and bears a scroll in its beak. The glass of the southern window of the cathedral of Chartres has preserved the same subject for us in painting, but at Chartres the evangelists are seated on the shoulders of the prophets with legs at each side. In that glass S. Jerome supports S. Luke; Isaiah S. Matthew; Ezekiel S. John; Daniel S. Mark."The place," says M. Didron, "that these attributes and evangelests should occupy is this in an ascending line from bottom to top; the ox, lion, eagle and angel (man).[2] In the angles of a square as one frequently finds them, the attributes of the evangelists must always be placed in the hierarchical order; at the top the angel is at the right and the eagle at the left of Christ; below the lion is on the right and the ox beneath the eagle. When this order is not followed, it is an error. Still men have not always been in accord, neither on the place to mive them, nor on the special application to be made of each evangelist." Since the 12 th century in western monuments, the order that we give is followed without exception, in the application of the symbols for each of the evangelists.

Note 1. p. Mon. d.icon. chret., grec et latine, with introd-and notes, by M. Didron, translated from Byzantine manuscript, Guide de la peintury, by Dr. Paul Durand. Imt. roy. 1845.

Note 2.p.352. These four figures are winged. In Iconographie grecque they have four wings, but in the sculptures of the middle ages in France they have but two.

EVANGILE. Gospels. Evangels.

A book containing the four gospels. In sculptures and paintings of the middle ages from the 11 th century, the book of the gospels is placed in the hands of the Christ-man in the form of an open or closed book; most frequently closed after the 13 th century. In the representations of altars the book of the gospels is placed on the table and is closed.

EVECHE. Episcopal Palace.

Episcopal or archiepiscopal palaces nowise differ from the urban habitations of lords in the middle ages. They have their great hall (hall of the synod), their open porticos and vast lodgings; nearly always they retain the marks of the feudal

residence, i.e., they are fortified externally, furnished with battlements and towers. (Arts. Palais, Salle, Tour). There now remain to us in France few old palaces of bishops or archbishops. Yet we shall mention here the archiepiscopal palace of Narbonne, 14 th century (now city hall and museum); the episcopal palaces of Laon, 13 th century (now palace of justice), of Meaux (substructure of chapel of 12 th century), of Auxerre, 12 th and 13 th centuries (now prefecture), the archiepiscopal palaces of Rouen (remains from 13 th, 14 th and 15 th centuriesU, of Sens (hall of the 13 th century), of Rheims (remains from 13 th and 15 th centuries); the episcopal palaces of Evreux (15 th century), of Lucon (15 th century), of Beauvais, 12 th and 13 th centuries, (now palace of justice), of Soissons (remains from 13 th and 16 th centuries).

EVIER. Waste Pipe.

Discharge of dirty water. In the offices of castles are nearly always found traces of waste pipes intended to discharge t the dirty water outside, that has served for washing vessels. These waste pipes consist of a stone cut in form of a basin w with a hole at the bottom and placed in a recess of the wall. The waste hole of the basin corresponds to a stone duct made in the thickness of the wall or forming a projection outside. Thus is arranged the waste pipe still to be seen in the castle of Verteuil (1), the basin being placed in the second story. Other waste pipes cast water directly outside by a gargoyle placed directly below the basin. Frequently these wastes are arranged in the opening of a window. M. Parker, in his Domestic Architecture of England, has given some of these wastes, arranged with special care. [1]

Note 1.p.353. This drawing was furnished to us by M. Alaux, architect at Bordeaux.

Note 1.p.354. See Some Account of Dom. Arch. in England. Vol. I. p. 129, 130.

EXTRADOS. Extrados.

Back of an arch or vault. Every masonry arch or form of jointing has its intrados anf its extrador. For an arch or section of a vault I, the inner surface A B of the voussoirs is the intrados, the exterior C D is the extrados. (Art. Construction).

FABLIAUX. Fables. Tales.

We shall not undertake here to explain how and at what epoch fables brought from the East and Greece entered into the poetry of the middle ages, the more so that very good works exist on that subject; [2] We shall only state that about the beginning of the 12 th century, there are found on religious and c civil buildings sculptured representations of some fables attributed to Esop, and which from that epoch were very popular in France. Alexander Neckam, whose birth seems to date back to the year 1157, and who studied and taught letters at Paris, made a collection of fables entitled Novus Aesopus (New Esop), in which we may indeed find many of Esop's fables restored in Latin for the use of schools. [3] Neckam probably merely gave a literary form suited to the taste of his tome, to fables k known to all and many times reproduced in sculpture and painting. The first fable in this collection is entitled, De Lupus et Grue. (The Wolf and Grane). And indeed this fable is one of those most frequently found in the edifices of the 12 th and beginning of the 13 th centuries.

On the portal of the cathedral of Autun, 1130 to 1140, exists a cipital that reproduces that well known fable (1). But after the 13 th century, scupture and painting often took fables as secondary subjects on the portals of churches, principally of cathedrals and on civil edifices; the artists decorated by t them the capitals, corbels and panels. In the 15 th century, fables were singularly numerous and almost all sarcastic, invented and arranged by the troubadours, of the 13 th and 14 th centuries, and furnished to the plastic arts an inexhaustible collection of subjects, that we see represented in stone and wood, in the sacred place as well as in the house of the citizen. Fifteen years since, an author well versed in the knowledge of our old French poetry wrote thus;-- [1] "To speak only of the troubadours, authors of fables, who are especially reproached for the cynicism with which they treat the most respectable persons, ecclesiastics anf women. But do not forget, that there was then neither press, platform or theatre. Yet there existed, as will always exist, power ridiculed and abused. Society is unfortunately so made, that there is necessary a sort of escape or vent for popular discontent; the troubadours, mockers and satirists, were a necessity, the need of

that unsettling [illegible] and lively [illegible]
[illegible]
to their contemporaries, since the wise and [illegible]
listened to those satires, was praised by them and rewarded t
their authors; for example, Rutebeuf, one of the finest represent-
ed of those old poets. And further, those satires [illegible] the
[illegible], for example, and their [illegible] In the contrary,
who does not understand the anger expressed by all authors of
the 12 th and 13 th centuries, who see their own lords, even
the kings of their country, leave it, abandon their obligations
and families, expose themselves to all fatigues, dangers and
diseases, for the sake of a religion, among others, rulers of
the Byzantines and lands of the crusaders, live in [illegible] in
the midst of abundance, luxury and often degeneracy and in
our time, have we not seen worse than [illegible] for repressing
abuses less shocking than those? Fables brought to our country
invented in France during the 12 th and 13 th centuries were
not made those tales, poems, romances, lively, clear and caust-
ic, light in form, profound in observation of the human heart.
Germany wrote the Nibelungen, a work of heroic and sentimental
poem in which the personages [illegible] and seem to exceed the limits
of reality. Italy [illegible] the tragic and epic poems,
of which Dante has rendered the most complete expression. Spa-
in rendered the Romancero, [illegible] comedies in [illegible]
form, in which [illegible]
[illegible] vehemence, in which the most [illegible]
ted the [illegible] of the [illegible]. This [illegible] of France, [illegible]
[illegible] like its climate, alone in the midst of the [illegible]
[illegible]
[illegible]
[illegible]
[illegible] seems [illegible]
the light turn of its fables, romances, [illegible] that
positive spirit of inflexible logic, that we have seen it de-
velop in the classic ages, as seems to shine over everything,
but however light its expression, that is the [illegible]. To
understand the arts of the middle ages in France, it is neces-
sary to know the literary works of our ancestors of the 12
th and 13 th centuries, of which [illegible] and [illegible] are
the last descendants. To [illegible] in [illegible], to sound the [illegible]

that unhealthy and corrupt society. Their too lively satires, even frequently coarse for our refined ears, did not seem such to their contemporaries, since the wise and chaste S. Louis listened to those satires, was amused by them and rewarded t their authors, for example, Rutebeuf, one of the least reserved of those old poets. And further, those satires against the monks, for example, had they slight motives? On the contrary, who does not understand the anger expressed by all authors of the 12 th and 13 th centuries, who saw their own lords, even the kings of their country, leave it, abandon their positions and families, expose themselves to all fatigues, chances and dangers, for the sake of a religion, whose priests, heirs of the fortunes and lands of the crusaders, lived in France in the midst of abundance, luxury and often debauchery? And in our days, have we not seen worse than fables for repressing abuses less shocking than those?" Fables belong to our country. Nowhere in Europe during the 12 th and 13 th centuries were not made those tales, poems, romances, lively, clear and caustic, light in form, profound in observation of the human heart. Germany wrote the Nibelungen, a sort of heroic and sentimental poem in which the personages act and speak outside the domain of reality. Italy tended toward the tragic and mystic poetrw, of which Dante has remained the most complete expression. Spain recited the Romancero, energetic in thought, concise in f form, in which the railing is bitter, envenomed, breathing p patient vengeance, in which the most tender sentiments retained the asperity of the wild fruit. This people of France, t temperate like its climate, alone in the midst of the Middle ages filled with massacres, misery, abuses and struggles, retained its good humor; it bites without wounding, corrects without pedantry, the tragic burkin provokes a smile, bitter satire seems sad to it. It speaks and rails, but it brings in t the light turn of its fables, romances, jesting songs, that positive spirit of inflexible logic, that we have seen it develop in the plastic arts, he seems to skim over everything, but however light its impression, this is ineffaceable. To u understand the arts of the middle ages in France, it is necessary to know the literary works of our troubadours of the 12 th and 13 th centuries, of whom Rabelais and La Fontaine are the last descendants. To dream in sporting, to sound the most

concealed recesses of the human heart, and the most delicate in a phrase, to unveil them by a jest, leaving the mind to divine what is said or does not appear, there is all the talent of our old authors and old artists, so poorly known. What is finer than the prologue of the romance of Renard? In some verses the author shows us the turn of his mind, disposed to jest a little at everybody, with a fund of observation, very j just and of practical philosophy.

Note 1.p.See article on the Poesie au moyen age, by M. Viollet-le-Duc Sr. Annales archaeologiques. Vol. 2. p. 281. pub. by M. Didron.

God drives forth Adam and Eve from the terrestrial paradise. (Old French poem).

This is clever and lively, like the fable of La Fontaine, the Creator who takes pity on those he has just punished, the simplicity of Adam who returns the sheep to their fold, the indiscreet ambition of Eve, the intervention of the man that reestablishes good order by the new effort, acts that denote the thoughts, no talks nor reproaches, that is the world that goes on well or badly, but which goes on always, and the spectators who look on, observe and laugh. However naive it is, this is never so, never requires from our troubadours those d developments of violent passion, for passion makes them smil e like all exaggerations; if they express a tender sentiment, t this is done in two words, they have the modesty of the heart, if they do not always have the correct word. In the most tragic situations, the personages never extend in long discourses, Is not that a very true observation of human feelings?

When the lord of Flayel has caused his wife to eat the heart of the lord of Coucy, he contents himself by saying to her, while showing her the letter that the noble sent to his love:-- (Old French poem).

Does the lady pour out imprecations, wring her hands, make a long discourse, and express her horror by exclamations? Does the author say that she became livid, remained voiceless, or could only articulate hoarse sounds? No, the author understands that this vengeance, displayed in a most disgusting meal, will easily fall into the ridiculous. The passion and despair of the woman are expressed by some words full of nobility and s simplicity; so well that the husband is vanquished. (Old poem).

It is only when she is in the midts of her women, far from the scene of the trigic banquet, and before dying that she expresses in some verses the most touching regrets.(Old poem).

Sometimes a thought filled with energy pierces the discreet murmur of passion in the French poems of the middle ages. In the same romance, when the two lovers are to separate, the l lady desires lord de Coucy to carry away the long tresses of her hair, he resists. (Old French poem).

But we are far from the fables and their striking charm. The plastic arts are the living image of these feelings, sometimes tender and even elevated, without ever being bombastic, t the artists, like the French poets of the middle ages, are a always restricted by the fear of overreaching the aim by insisting; it is a case here for following their example. Only at the end of the 13 th century, artists commenced to select some satiririCal scenes from these fables in the 14 th century, they entirely freed themselves, and did not fear to personify a criticism of the customs adopted everywhere under the form of fables. In the 15 th century occurs a veritable unrestraint, and those grotesque and ticklish subjects, that we t then see reproduced even in edifices consecrated for worship, are not the product of barbaric caprice, but an increasingly vivid protest against the abuses of the age, and particularly the religious orders. We cannot repeat too frequently, that t the inferior lay class during the middle ages follows from t the 12 th to the 15 th centuries a logical course. It could express its feelings of anger, its love of satire, only in the productions of art; this was the sole liberty left to it. it profited largely by this, and with persistence that in spite of the liberty in form, sprung from the instinct of the just and true, very laudable, that we should be very wrong to misunderstand.

FACADE. Facade. Front.

The name of facade is applied today to the entire architectural arrangement looking on the exterior, the public street, a court or garden. But it is only since the 16 th century in France, that have been erected facades as one would arrange the decoration before an edifice, without taking more or less care for the relation of this facing to the internal arrangem-

arrangement. The ancients, nor the architects of the middle a ages did not know a facade arranged with the sole thought of pleasing the eyes of the passers. The external fronts of the good monuments of antiquity or of the middle ages are only t the expression of the internal arrangement. As for churches, for example, the principal facades oppos1te the chevets are n nothing but the transverse sections of the naves. For houses, the facades on the street consist of a gable if the house presents its end, or of a wall pierced by doors and windows if on the contrary, the house fresents its longer side to the e exterior. Every building of the middle ages is always built o on a parallelogram, the gables being raised at two opposite ends. Thus, Fig. 1, the building of the middle ages presents two gables A and two side walls B. If several buildings are joined together, they form a combination, Fig. 2, of a greater or lesser number of these distinct buildings, and their f facades are nothing more than a more or less decorative arrangement of the openings on the exterior. This principle sufficiently shows that what we understand today by facade did n not exist in the architecture of the middle ages. A palace or house possesses its external fronts, but these fronts are nothing but a necessary appearance of the arrangements of the plan, of the lodgings or internal construction. In brief, in the architecture of the middle ages, the facade cannot be separated from the general arrangement of the building, for it is the result. We refer our readers to Arts. Cathedrale, Chateau, Maison, Palais, Architecture Religieuse, Monastique and Militaire.

FAITAGE. Ridge.

Upper part of a gable roof. (Arts. Charpente, Crete, Faitiere).

FAITE. Ridge-piece.

Horizontal timber connecting the two upper ends of the principals of the trusses. (Art. Charpente).

FAITIERE. Ridge Tile.

Crowning tiles of a gable roof. These tiles are plain or decorated, single or double. When they are ornamented, they form an actual ridge of terre cotta more or less open against the

[illegible] ridge tiles of the thirteenth [illegible] [illegible] of very large dimensions, were jointed, and [illegible] [illegible] [illegible] to the roof [illegible]. [illegible] these tiles are [illegible] [illegible] of the [illegible] of the ridge. We have also seen on the roofs of the [illegible] of [illegible] [illegible] of very old ridge tiles (probably of the [illegible] century), [illegible] [illegible] [illegible] ft. long, and [illegible] must have been set jointed with a mortar joint between them.

Here, Fig. 1, is one of these ridge tiles of terra cotta of good quality, glazed black-brown on the exterior. The [illegible] were slightly raised to receive [illegible] [illegible] the joint, which was filled with mortar. The knobs [illegible] 4.7 [illegible] [illegible], and were very rudely modeled by hand. [illegible] it was [illegible] that these jointed ridge tiles, in spite of the mortar joints, allowed water to pass into the [illegible], and [illegible] ridge tiles were [illegible] as [illegible] [illegible] Fig. [illegible]. The [illegible] [illegible] [illegible] of the [illegible], they were always set in mortar, [illegible] [illegible] to leave no [illegible]. [illegible] the [illegible] of the [illegible] century were also made ridge tiles for covering [illegible] roofs ([illegible]), each ridge tile having a [illegible] [illegible] covering the [illegible] on the [illegible] one. [illegible] ridge tiles [illegible] water, and to allow [illegible] hold for the [illegible], for the wind [illegible] on a [illegible] surface. It is certain that the tile-makers of the middle ages [illegible] in making ridge tiles [illegible]; they understood that these ridge tiles must have [illegible] weight to resist the wind and to [illegible] the [illegible] of the roof, [illegible], [illegible] when these roofs were composed of [illegible]. [illegible]; hence they [illegible], that are [illegible] projecting knobs or low [illegible] [illegible] and consequently [illegible]. [illegible] on a [illegible] in the little [illegible], one of the [illegible] of the [illegible] of [illegible], [illegible] tiles of terra cotta, very [illegible] in their [illegible]. We give both here ([illegible]). [illegible] appear to belong to the 13 th century, are of small dimensions, and the glaze covering them is brown. These ridge tiles were set [illegible]. [illegible] on houses [illegible]

sky. Ridge tiles of the Romanesque epoch are generally of very large dimensions, set jointed, and frequently ornamented by knobs serving to set them easily. These knobs form the continuous ornamentation of the cresting of the ridge. We have also seen on the roofs of the church of Vezelay remains of very o old ridge tiles (probably of the 12 th century), not less than 2.3 ft. loug, and that must have been set jointed with a mortar joint between them.

Here, Fig. 1, is one of these ridge tiles of terra cotta of good quality, glazed bluish-green on the exterior. The ends A were slightly raised to remove rain from the joint, which was filled with mortar. The knobs project 4.7 to 5.9 ins, and were very rudely modeled by hand. Later it was recognized that these jointed ridge tiles, in spite of the mortar joints, allowed wet to pass into the carpentry, and these ridge tiles were l lapped as indicated by Fig. 2. Yet to prevent their disarrangement by the wind, they were always set on mortar, taking care to leave no crevices. About the beginnig of the 13 th century were also made ridge tiles for covering tile roofs (3), each ridge tile having a hollow A for covering the round B on the next one. A fire glaze always covered these ridge tiles to make them less pervious to water, and to allow less hold for the wind, for the wind does not act on a smooth as on a rough surface. It is certain that the tile-makers of the middle ages observed in making ridge tiles the laws that governed lead-w workers; they understood that these ridge tiles must have considerable weight to resist the wind and to strengthen the ridge of the roof, that always needed to be loaded, principally when these roofs were composed of trussed rafters (Arts. Charpente, Crete); hence they soon gave them ornamental appendages, that are only slightly projecting knobs or low reliefs during the Romanesque epoch, then more decided and projecting forms, and consequently great weight. Some years since were to be s seen in the little museum installed by M. Ruprich-Robert in one of the dependencies of the cathedral of Bayeux, two ridge tiles of terra cotta, very curious in their manufacture. We give both here (4, 4 bis). They appear to belong to the 13 th century, are of small dimensions, and the glaze covering them is brown. These ridge tiles were set jointed. One still sees at Troyes on houses near the cathedral some ridge tiles accor-

according to the drawing, Fig. 5, glazed brown. These perforated appendages forming the cresting were necessarily fixed o on the ridge tile before burning. But in the fire they frequently cracked or bent. These pieces of terra cotta by their form and dimensions occupied much space in the furnace, were difficult to store, and their buring must often be very unequal. When in the 14 th century public and private edifices became richer and more refined, it was necessary to give the c crests of roofs covered by tiles more slender forms, more lightly outlined against the sky; then were made ridge tiles w with ornaments that harmonized. After that system were made the ridge tiles of church S. Foi of Schlettstadt. [1] These consist of the ridge tile proper, Fig. 6, being a double pierced stem with round hole into which fits a small iron pin. The upper part of this pin above the bed B receives the maple leaf A, properly modeled and glazed. These ridge tiles date from the beginning of the 14 th century. The rusting of the lins a and the small bearing of these ornaments must cause breakage of these delicate stems; yet men proceeded to give increasing importance to the crestings of terra cotta; about the 15 th century they returned to uniting before burning, but placing the raised ornaments on the lower ridge tiles, that were short, and only decorating the ridge tiles by slightly projecting ornaments. According to this method were made the old ridge tiles of the roof of the cathedral of sens, whose covering of glazed tiles dates from the end of the 15 th century.(7). The sub-ridge tiles A are glazed yellow, and the great ridge tiles are glazed green. [1] One notes the holes that pass through the double curved vase of the sub-ridge tiles; these holes are s scarcely visible at the height at which is placed this cresting, and have no purpose other than to produce whistling under the action of the wind, and which probably pleased very much the neighbors of the church. We have frequently found on the crownings of edifices, and particularly of the roofs, traces of these singular musical caprices. During the middle ages m men did not attach to certain natural phenomena the romantic ideas suggested to us by modern literature; whistling of the wind through the buttresses and perforations of edifiles, which produce gloomy thoughts in our minds, was perhaps for the ears of our fathers a pleasing harmony. However that may be,

the idea of crowning the roof of the edifice by a hundred whistles is passably original.

Note 1.p.362. This drawing was furnished to us by M. Boeswilwald.

Note 1.p.364. Fragments of the ridge tiles collected by M. Lefert, diocesan inspector of Sens, deposited on the office of the agency of the works.

To avoid the difficulties still presented by the firing of the pieces A of the preceding Fig., it was conceived to make the upper pieces set to cover the others as we see done for t the terminals of terra cotta. (Art. Epis).

Here (8) is a cresting so combined. [2] The lower ridge bears a sort of neck B (see section B'), on which is set the cap C in the form of a turret pierced by 4 holes. The lower ridge is glazed blackish-greenlike the ridge, the caps are covered by yellow glaze, and the little cone is black. There is reason to believe that all tile roofs were formerly crowned by t these perforated ridge tiles; only a small number are now found in place; but thanks to the well known negligence of roofers, who do not take the trouble to lower the replaced tiles when they repair roofs, one can collect in the haunches of the vaults of our edifices of the middle ages a quantity of fragments of pottery, often very precious, since they give us specimens of these decorations of roofs; hence we cannot too strongly recommend architects called to repair old buildings to examine those fragments accumulated beneath the roofs by the negligence of roofers.

FANAL. Beacon.

(Art. Lanterne des Morts). The beacons designed to present at night a light to guide mariners on the sea or rivers, consisted only of a great lantern suspended to a crane at the t top of a tower. The Tower of Nesle at Paris bore a beacon kindled each night to indicate to seamen the entrance of Paris. On the seacoast, where these lanterns could not furnish a light sufficiently strong to be seen afar, there were placed on the towers iron crates filled with tarred oakum. Watchmen were charged with maintaining these fires during the night.

Note 2.p.364. Fragments found on the vaults of the church of Semur-en-Auxois. that appear to date from the 15 th century.

FENETRE. Window.

The architecture of the middle ages being perhaps of all kn known architectures, that which most exactly submits to the needs, convenience, and the arrangements of programmes, it d does not present a great variety of windows, particularly at the time when this architecture abandoned the Romanesque tradiditions. Indeed the window is made to give light and air to the interior of a hall or chamber; if the nave be great, it is n natural for the window to be great; if it be only necessary to light a cell, it is understood that the window may be small. In a church where men gather to adore the Deity, there is no need to see what passes outside; but in a hall for a civil use, on the contrary it is necessary to be able to look out of the windows; to look from the windows it is necessary to open them easily. Thus there are the general rules that must produce a difference in the forms of windows belonging to religious a and civil edifices.

The private habitations of the Romans were not at all arranged like ours. The rooms reserved for sleeping, in brief, the bedrooms, were small, and often received light only through the door opening on a portico. For rich men were established, besides courts surrounded by porticos, large rooms intended f for assemblages, banquets, and sports, and they took care as much as possible to arrange these rooms with the most favorable orientation; then frequently the windows were only closed by gratings of wood, metal, or even of stone and marble. Although the Romans were acquainted with glass, they did not make it in large pieces; it was evidently an object of luxury, and in common houses it was probably omitted, or at least used with parsimony. During the first centuries of the middle ages, glas must have been a material so rare that men avoided to use it. Note this first, that even today in Italy, Spain, and even in southern France, there is not required in interiors the light, that we love to diffuse in our apartments or in our public edifices. In southern countries life is outdoors, and men rarely shut t themselves in, except to meditate and sleep; now to devote one's self to meditation there is no need of much light, still less to sleep or rest. The Romans did not modify their architecture by reason of climate, but built at Cologne or Paris as at Rome, and left in Gaul traditions abandoned only quite late. In pub-

public edifices windows were great round-arched openings pierced beneath vaults through the enclosing walls; in the habitations the windows were only very narrow rectangular openings to receive wooden gratings on which was placed oiled paper or canvas, or bits of glass were inserted in the network of wood or metal. Rarely in public edifices were windows glazed; or indeed they were sufficiently narrow to prevent the wind from sweeping the interiors; or if large, they were furnished with gratingsof stone, metal or wood intended to soften the wind coming from the exterior. Many churches and Romanesque halls until the 12 th century possessed windows without any closure or grating. The form of these windows is introduced in Fig. 1. Not having sashes, it was natural to arch these openings and to give them a large splay inside to facilitate the entrance of light. When these openings were narrow (which was common, to break the force of the wind as much as possible, they did not take the trouble to turn a cut arch over the jambs externally; but contented themselves with cutting the stone in the form of an arch, and the cut arch was reserved for the splay, in order to support the load of the upper construction. The external construction forming an arched lintel, had only the thickness of the slab A B (2). Nearly always during the first centuries, i.e., from the 8 th to the 11 th, the jambs of these openings consisted of great stones on end with bands above the sill and under the arch. The primitive Romanesque window was thus constructed like the antique window. As for the proportions of these windows opened in edifices, they are subjected to the place assigned to them; then are generally short in t the lower stories and long in the upper stories. Besides the idea of defense dominating all Romanesque structures of the 8 th to the 12 th centuries, men took care to open only small windows in the ground story, often too narrow for men to pass through; or indeed if induced to make rather wide openings, the window was divided by a little column as indicated by Fig. 3. In this case the window really consisted of an arch having the width E F and round arch D; on the exterior were set double arched lintels G on a little column, whose actual function was to serve as the closure or grating. The round arch D did not appear externally and served as a discharging arch from H to K. Our Fig. shows at A the window on the exterior, at B is

the section through the middle of the little arches C and the great arch D.

In the provinces the windows, during the Romanesque period and up to the middle of the 13 th century, present striking differences. Relatively wide in the north, they are narrower as one approaches the south; yet there are some exceptions to that general rule, thus the windows of the religious edifices of Auvergne, Saintonge, Perigord and a part of Languedoc, during the 11 th and 12 th centuries are ar wide as the windows of Ile-de-France and Normandy, while on the banks of the Saône and the Rhone they are very narrow. We shall give here some examples of the religious edifices or of public monuments erected on the same principler for the arrangement of the windows. It is a law already observed by the Romanesque architects and developed with much intelligence by the constructors of the 13 th century, that it is necessary for us to make known fully to our readers, for it seems to have been nearly forgotten in our time. The light passing through a window into an interior forms a cone or pyramid according to the form of the opening; i.e., that instead of being divergent, the luminous rays converge from the exterior to the interior; thus let (4) there be an opening a b c d, the exterior being at A, the direct a and full light forms a pyramid a b c d e, and all not comprised in that pyramid will only receive diffused or reflected light. A pyramid will be longer or shorter according as the o opening is more or less orientated toward the course of the sun. If the rays themselves of the sun pass through this opening, the luminous group will form a prism, but which is not infinite. For example, assuming a square opening a b c d in the wall (5), the exterior being at A, the solar rays passing through that opening will form a prism a b c d, a'b'c'd'. But if we have at B a wall distant from the opening more than 20 times the diagonal of the square, the projection of these solar rays through the wall will be already much changed; if this wall be at a distance of 100 times the diagonal of the square hole, it will have only a diffused spectrum; if much farther, the solar rays will leave no trace; the direct solar rays will leave no trace; the direct solar light is then itself changed by the sides of the opening allowing it to be introduced into the closed nave. A person placed at the back

of a cellar 1641 ft. long whose opening is only 6.6 ft., assuming that the solar rays pass along the axis of the cellar, will perfectly distinguish the opening, but will receive no light. Thus even assuming the direct solar rays, the luminous groud always diminishes in diameter from the exterior to the interior; hence every window must have an opening proportioned to the extent of the interior to be lighted; if this opening be too small, one sees the window, but it no longer gives direct light, and it is not so much the number of windows, that gives a clear light in the interior as their relative dimensions. A square hall with sides of 82. ft., lighted by 20 windows, each with 10.76 sq. ft. area, would be quite dark at i its centre, while 2 windows of 107.6 sq. ft. each pierced in two opposite walls would light the centre sufficiently for one to read there. The luminous surfaces, in brief the windows, must then be calculated according to the extent of the interiors. It is understood that we speak only of windows taking direct light from the sky, for if they only receive reflected light, it is evident that the luminous pyramid or cone produced in the interior would be much shorter. Observation gradually led the architects of the 12 th century to apply these laws, that the love of symmetry has caused us to neglect, for to obtain on the exterior facades pierced by windows of similar dimensions, we have come to light great halls and little rooms by means of similar windows; we no longer know, or we no longer desire (to satisfy certain classical laws that the ancients took good care not to apply) to produce great effects of light in interiors by means of windows more or less large; we have lost the sentiment of the picturesque in the mode of lighting interiors. Yet the arrangement of openings in the i interior, especially if the nave be grand and divided as one of the means for obtaining powerful effects without cost. We see Romanesque architecture, when it separated itself from barbarism, carry very far that knowledge of the introduction of daylight into the interior of churches and its great halls; that architecture admits that certain parts of the nave must be lighted more than others; it will overwhelm a sanctuary w with light and leave the nave in half light, or indeed will open enormous windows in the ends of transepts, while leaving the sanctuary in obscurity, or again indeed it will pierce s

small windows in the walls and side aisles, so that they will make the high vaults luminous; it will proceed with light as it proceeds when it is necessary to decorate an arrangement; it knows how to make sacrifices; it is sober here to appear more brilliant at some point; it employs means that had been the privilege of our art before the classical era; it thinks that the windows do not exist for themselves, that their dimensions and form are the result of the interior to be lighted. It is to be believed that Greek architects, Roman architects, and those of the middle ages would be very much surprised, if they saw us give in publications on the art of architecture examples of windows without stating how, why and where these openings are made, what are the halls lighted by them. That is indeed as strange, as it would be in a publication on natural history of animals to give a collection of ears, presented without taking into account the heads that bore them. An ass' ear is certainly very beautiful, but on condition that it ornaments the head of an ass. Hence we shall endeavor in presenting examples of windows, since this concerns this important architectural member, to indicate their places and f functions, and to explain the reasons that caused the adoption of such a form and arrangement.

FENETRES APPARTENANT A L'ARCHITECTURE RELIGIEUSE.

Windows belonging to Religious Architecture.

We have already stated that in the old churches, i.e., in those built from the 8 th to the 11 th centuries, the windows received no glass, and that glass was an exception; that these windows were open,or partly closed to stop the wind by gratings of stone, wood or metal. That was an antique tradition. In the rude provinces of upper Burgundy, the Cluniac churches permitted no closure of their windows until the 12 th century. The windows of the nave of Vezelay, 1190 to 1110, upper and l lower, were without glass or gratings, allowing the air and light to pass freely. Here is Fig. 6, one of those windows.[1] The horizontal section of these openings at A gives a double bevel without groove or stop to receive a sash. This bevel on the exterior had the advantage:- 1, to allow the light to enter readily; 2, to obstruct the action of the wind, that entered between these two inclined surfaces. A slope B outside rejects rain. In the interior the sill C extends at the level

of the abacuses of the capitals. The archivolt F is placed di-
rectly under the side arch of the vaults, the round arches of
these openings are then concentric with the side arches, but
profit by the height of the side arches to introduce the most
light possible. At Y we present the external view of this win-
dow.

Note 1. p. 370. Of the aisle chapels; those of the high nave are traced on the same plan but are longer; the sills are much inclined still to cause the light from the sky to strike directly on the floor.

Yet in the provinces of the West, about the same epoch, win-
dows were more civilized, and the interiors were not thus left
exposed to all winds; at the end of the 12 th century the win-
dows were small, narrow and often filled with stone gratings
of quite delicate work and pleasing design. There exist but
a very small number of examples of these gratings, later re-
placed by glass. We give one in Fig. 7 from the church of Gen-
ouy. This is a slab of about 0.2 ins. thick at a width of
0.6 ins. The [illegible] is [illegible] and delicately cut; the openings
are bevelled externally and internally. Our Fig. presents the
external face of the slab, which is set in a groove
cut in the splay of the window, as indicated in Fig. 7 [illegible],
showing the outer side. The least of the windows opened in
the walls of religious edifices of the 12 th and 13 th centu-
ries were generally without any ornamentation; the archivolts
alone in the 11 th century were sometimes surrounded by a ro-
ll moulding, solid or with a fillet; yet already in the south-
western [illegible] sought to avoid an appearance of simplicity by placing
under the archivolts two little columns as jambs, and that as
the sort of enclosure gives lightness and richness to the
[illegible]. That method is followed in the churches of the pro-
vinces of the Centre, since [illegible] this epoch, at Nivel-
le, [illegible], a part of Burgundy, [illegible] and Lor-
raine. The sills in the windows remained simple and are as
surrounded by the arch supported inside on little columns.
Thus are made the windows of the sanctuary of the churches of
Notre-Dame-du-Port at Clermont, [1] and of S. Etienne of Nevers.
These last windows were always closed by panels of glass or
glass set in leads and maintained by means of iron bars.(See
Vitrail). When the naves had tunnel vaults, the windows very

of the abacuses of the capitals. The archivolt D is placed directly under the side arch of the vault; the round arches of these openings are then concentric with the side arches, but profit by the height of the side aisles to introduce the most light possible. At E we present the external view of this window.

Note 1. p. 370. Of the side aisles; those of the high nave are traced on the same plan but are longer and have inside a much inclined sill to allow the light from the sky to strike directly on the floor.

Yet in the provinces of the West about the same epoch, manners were more civilized, and the interiorswere not thus left exposed to all winds; at the end of the 11 th century the windows were small, narrow and often fitted with stone gratings of quite delicate work and pleasing design. There exist but a very small number of examples of these gratings, later replaced by glass. We give one in Fig. 7 from the church of Fenioux. [1] This is a slab of stone 2.2 ins. thick for a width of 10.6 ins. The stone is hard and delicately cut; the openings are beveled externally and internally. Our Fig. represents t the external face of the slab, which is not set in a groove but in the splay of the opening, as indicated in Fig. 7 bis, A being the outer side. The jambs of the windows opened in the walls of religious edifices of the 10 th and 11 th centuries were generally without any ornamentation. the archivolts alone in the 11 th century were sometimes surrounded by a rope moulding, solid or with billets; yet already in the sanctuaries men sought to avoid an excess of simplicity by placing under the archivolts two little columns as piers, and that as the sort of enclosure giving importance and richness to the openings. That method is followed in the monuments of the provinces of the Centre, which date from this epoch, in Auvergne, Nivernais, Berry, a part of Languedoc, Lyonnais and Limousine. The slabs in the windows remained simple and are as if surrounded by the arch supported inside on little columns. Thus are made the windows of the sanctuary of the churches of Notre-Dame-du-Port at Clermont, [1] and of S. Etienne of Nevers.[2] These last windows were always closed by panels of pieces of glass set in leads and maintained by means of iron bars.(Art. Vitrail). When the naves had tunnel vaults, the windows very

rarely penetrated the vault, the extrados of their archivolt being set directly under the springing of the vault; this arrangement compelled the architects to carry their eave walls much above the eave walls of these windows in order to be able to place, either the mass bearing a covering and laid directly on the vault, or carpentry. That portion of the base wall above openings relatively small produced a very bad effect; hence in provinces where the art of Romanesque architecture had attained a certain degree of elegance and refinement, men sought to decorate those bare parts. The walls of the cathedral of Puy-en-Velay present one of the motives of external m mural decoration between the windows pierced beneath the high vault and the cornice. (8). Sunk panels arranged in the thickness of the wall decorated by mosaics and little columns occupy the bare parts, enclose the openings in graceful fashion without taking from the construction a solid appearance that it should retain. The window itself is covered by a well cut double archivolt, the external one resting on two little columns. Thus from the small openings, really very simple, the architects of Auvergne of the end of the 11 th century have made an ornamental motive of great importance to the exterior.

Note 1.p.371. M. Abodie collected fragments of gratings, t that he very kindly communicated to us. The church of Fenioux depends on Saintonge, it is located now in the department of Charente-Inferieure; it is one of the most curious monuments of that part of France.

Note 1.p.372. Art. Chapelle, Figs. 26, 27.

Note 2.p.372. Art. Arcature, Fig. 16.

It is unnecessary to enlarge further on Romanesque windows of religious edifices; besides that they present few varieties, we shall often have occasion to give examples of them in the course of this work, and this would form a double use to present here a great number; yet we must mention certain works, that belong exclusively to the Carlovingian monuments of the East, and that possess a special character. These windows are double or trible and rest their archivolts (9) on single small columns of marble or very hard stone (to resist the load), surmounted by an abacus extending in one direction for the th thickness of the wall; an arrangement that section A will make understood.[1] In this case the little columns were only struts

set at the middle of the thickness of the wall and supporting the equilibrated load. It is unnecessary to state that these windows were not glazed; hence they were usually opened only in towers or galleries not opening into the interior. This sort of windows are seen in some Italian towers built of brick, pretended Lombard towers.

Note 1.p.373. From the cathedral of Spires (towers), 12 th century.

Let us come to the epoch of transition during which the windows of religious edifices assumed very diverse forms.

The cathedral of Noyon, built about 1150, shows us already a system of windows entirely novel. The upper parts of the t transepts of that church, built in circular plan, are lighted by long twin round-arched windows opening on the external gallery passing through great buttresses abutting the edges of t the vaults. The plan in Fig. 10 shows us twin windows at C w with their rebates to receive glazing, the external gallery at B, the interior of the nave being at A. A long and small monolithic column repeats externally the double opening while allowing as much light to enter as possible. A discharging arch resting on the jambs and the little column D supports t the upper cornice.

The perspective view (11) taken externally, illustrates the entirety of that arrangement, then novel. By this means the architect obtained in the interior beneath the vaults a very beautiful light; he possessed a service gallery that facilitted setting and maintenance of the glass, the projection that sheltered them from wind and rain, the construction both light and solid, for the great discharging arch is double and b bears the upper part of the construction and carpentry. One perceives here already that the architects sought to introduce wide luminous rays into the interiors, that they suppressed the walls and felt the necessity for increasing the translucent areas as they erected greater monuments. This true principle rapidly brought very important modifications in the structure of religious edifices. The space left between the piers bearing the vaults and the side arches of these vaults became a glazed opening; but as it was necessary to maintain an iron framework to support the glass, and these frames presented an enormous surface to the wind, the openings were divided by p

piers, arches, eyes and stone tracery, which opposed a solid obstacle to the effect of the wind, that were durable and allowed one easily to replace portions of the glass brogen out by hurricanes. The stone filling being for the architects so much a necessity of construction, that they did not place it in openings, that by their position near the ground or their narrowness imposed by the small distance between the piers, could without inconvenience be fitted with simple iron bars. For example, in the side aisles, the architects also did not believe it necessary to entirely open the walls between the buttresses, because the side aisles not being very wide needed no such great area of light as the principal naves, since men still adhered to Romanesque traditions, and always closed well the lower parts of edifices. In church S. Yved of Braisne the side aisles of the choir and high nave even present t these windows in a state of transition (12), while in the c cathedral of Soissons, the lower windows are nearly similar to those of S. Yved, but the high windows of the nave alreadv possess stone tracery constructed of courses under the archivolts concentric with the side arches of the high vaults. Fig. 13 shows us one of these openings on the exterior; at A we h have traced the section of the archivolt and of the tracery on a b. A projecting passage on the exterior beneath the sills of thise windows and covering the triforium, permits placing and repairing the glass without difficulty. If one looks for an instant at the construction of the stone tracery, he will see that the construction consists of a central pier, of two arches with extradoses, an independent eye receiving in a g groove cusps forming a rose with 6 lobes. Between the eye and these arches is set the filling of masonry. The ccusps support at their ends by as many claws, the iron circle that serves to attach the glass panels. In each opening beneath the arches rises a vertical bar, crossed by horizontal bars forming a s series of regular panels. The glass are held to these bars by keys passing through loops and by grooves cut in the jambs of the central mullion. (Art. Armature). Thus from the end of t the 12 th century (for the windows date from that epoch or the first years of the 13 th century), the built mullions were adopted for the great windows of the great religious edifices belonging to the French provinces. It must be recognized that

the architects of this epoch of transition sought, experienced, tried several methods, yet only ventured them and hesitatingly, knowing perfectly what they desired, but attaining the end by different ways. At Chalons-sur-Marne about 1170 the architect of the choir of Notre Dame also desired to abandon Romanesque traditions and to open great windows beneath the high vaults. How did he undertake it? Having obtained very wide bays by the location of the piers, he raised the side arches of the vaults as much as possible, taking care even to trace them in a very flat pointed curve, Fig. 14. Beneath these arches he opened three windows of almost equal height, separated by two little piers. The engineering of Champagne was always in advance of the adjacent provinces, and led the constructor to connect the window with the triforium; he then carried the two little monolithic columns A of the piers separating the openings down to the sill of the triforium, setting two small corbels to receive their bases. As for the two other little columns B. at the jambs, they descend to the abacuses of the lower capitals, for one will observe that here is no projecting moulded side arch, and that the vault rests directly on the upper tympanum C.[1] The arrangement of the window, instead of being separated from the arrangement of the triforium, as in the edifices of Ile-de-France of the same epoch, is connected with it; which singularly enlarges the interior of the nave. This triforium is very small, and its scale is reduced because it becomes only the deeper sill of the window. At D we have given the plan of the openings at the level O', and at E the external face of the archivolts of the three windows, that can be divided on the exterior of the gallery serving to cover the triforium. In regard to this one will observe that generally the high windows are glazed from the exterior, while those of the side aisles have the panes glazed from the inside. There are good reasons for so proceeding; that the low window being glazed from the outside, it is easy for criminals to remove at night some keys and bars, to dislodge a panel of the glass and enter the church; while that operation cannot be attempted if the panels of the glass are set, the keys and bars being inside. But in the upper part of the edifice, that danger would not be found, while it would be necessary to take certain precautions to prevent the rain driving against the

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glass from entering between the panels; then the panels being set inside and the heavy [illegible] driving the rain against them, the water stopped at each cross bar and easily entered at their joints; there was then the advantage of placing the windows most exposed to wind on the outside; thus could be avoided the overlapping of the lead of one panel over another, obtaining a smooth surface without projections, stopping the rain at no point. But it may perhaps be thought that we e[illegible] into minute details; yet in truth there is no detail in the execution of architectural works, that does not have its importance, and the true artists are those that know how to [illegible], [illegible] to the least details as to the most important; those the architects of the middle ages were good artists.

Note 1.p.273. For the section of the windows with the general system of the construction of that time, see Art. Construction, Fig. 44. At 5. [illegible] of [illegible]. the construction of the upper windows of the choir is similar to this.

Note 2.p.273. See Art. Construction, Fig. 46.

About the beginning of the 13 th century, the architect of the cathedral of Chartres sought combinations of windows entirely novel for lighting the high nave. In the side aisles he was restricted to the opening of the bays, i.e., he had placed arcades [illegible] by [illegible], not filling the space between the piers; he had desired to leave to this architecture the appearance of a wall. But we see that in the upper part of the edifice [illegible] the space; from one pier to another he threw a great arch, and in the [illegible] above the triforium, he opened two side windows surmounted by a great rose window, Fig. 15, (see section C); A is the side arch forming the archivolt on the exterior, doubled by a great arch B giving the thickness of the vault V. The enclosure of the rose R receives in a groove glass pierced by quatrefoils and forming wide voussoirs. At [illegible]

well to compare these windows with those given above (Fig. 14) or the old ones of the cathedral of Paris, very little earlier. The frankness in this construction of Notre Dame of Chartres a boldness and power, that contrast with the experiments of the architects of Ile-de-France and of Champagne.

glass from entering between the panels; then the panels being set inside and the heavy winds driving the rain against them, the water stopped at each cross rod and easily entered at their joints; there was then the advantage of glazing the windows most exposed to wind on the outside; thus could be arranged the overlapping of the lead of one panel over another, obtaining a smooth surfacewithout projections, stopping the raindrops at no point. But it may perhaps be thought that we e enter into minute details; yet in truth there is no deteil in the execution of architectural works, that does not have its importance, and the true artists are those that know how to devote care, observation and study to the least details as to the most important; hence the architects of the middle ages were true artists.

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About the beginning of the 13 th century, the architect of the cathedral of Chartres sought combinations of windows entirely novel for lighting the high nave. In the side aisles he was restricted to the custom of the time, i.e., he had pierced windows terminated by equilateral arches, not filling the space between the piers; he had desired to leave to this substitute the appearance of a wall. But we see that in the upper part of his edifice he changes the system; from one pier to another he turns round side arches, then in the enormous bare space remaining in each bay above the triforium, he erects two wide windows surmounted by a great rose window, Fig. 15, (see section C); A is the side arch forming the archivolt on the exterior, doubled by a great arch D giving the thickness of the vault V. The enclosure of the rose R receives in a groove slabs pierced by quatrefoils and forming wide voussoirs. At B are traced the elevations of the flying buttresses. It is well to compare these windows with those given above (Fig. 14) or the old ones of the cathedral of Paris, very little earlier. One recognizes in this construction of Notre Dame of Chartres a boldness and power, that contrast with the experiments of the architects of Île-de-France and of Champagne.

At Chartres is seen for the first time, the construction fron- [illegible] bay, taking the size arch of the vault as the archivolt of t the window. Simplicity of composition, true and solid construction, strong location, beauty of form and judicious use of materials, all qualities are found in this magnificent specimen of the architecture of the beginning of the 12 th century. Further do not forget these arches, piers, pierced slabs, are made of stone from Berchere of strength under dry test, greatly quarried in great blocks and of coarse appearance; which also adds to the grand effect of the masonry. One cannot doubt that the quality of the limestone materials employed by t the architects of the primitive Gothic epoch was for much in the adoption of the system of construction of the great windows. That was done at Chartres at the beginning of the 12 th century, could not have been done with the materials of the basins of the Oise, Seine, Aisne and Marne. In those provinces men did not think of employing pierced slabs or could not do so; windows were coupled, enlarged as much as possible, b but did not dare to close them with stone tracery. In Burgundy where the materials are very resistant, about the second half of the 12 th century, rose windows were filled by tracery of pierced slabs (Art. Rose), but not in the other windows. At Laon about 1170, the architects also hesitated between the forms of windows of the Romanesque epoch and those recently opened in the religious edifices erected, like the cathedral of Noyon, the abbey church of S. Denis. On the right wall of the transept of the abbey church S. Martin at Laon, although the structure of the church is already Gothic, we see windows that do not entirely abandon Romanesque traditions (15). Round and pointed arches mingle, and the new school only accepts in the form of the traditions. Even here the round arch appears above the pointed arch; which also proves that during the epoch of transition, the architects felt themselves free to adopt either of these arches according to the needs of construction. The lower window is covered by the pointed arch, because this window is wider than the other, and the constructor has wished to give more solidity to its construction by supporting the jambs of the upper window on the spandrels of the arch, while profile appearances were nearly the horizontal line. He was a

At Chartres is seen for the first time, the construction frankly adopt the upper windou occupying the entire width of the bay, taking the side arch of the vault as the archivolt of t the window. Simplicity of composition, true and solid construction, strong jointing, beauty of form and judicious use of materials, all qualities are found in this magnificent specimen of the architecture of the beginniug of the 13 th century. Further do not forget these arches, piers, pierced slabs, are made of stone from Berchere of strength under any test, easily quarried in great blocks and of coarse appearance; which also adds to the grand effect of the masonry. One cannot doubt that the quality of the limestone materials employed by t the architects of the primitive Gothic epoch was for much in the adoption of the system of construction of the great windows. What was done at Chartres at the beginning of the 13 th century, could not have been done with the materials of the basins of the Oise, Seine, Aisne and Marne. In those provinces men did not think of employing pierced slabs or could not do so; windows were coupled, enlarged as much as possible, b but did not dare to close them with stone tracery. In Burgundy where the materials are very resistant, about the second half of the 12 th century, rose windows were filled by tracery of pierced slabs (Art. Rose), but not in the other windows. At Laon about 1150, the architects also hesitated between the forms of windows of the Romanesque epoch and those recently opened in the religious edifices adjacent, like the cathedral of Noyon, the abbey church of S. Denis. In the gable wall of the transept of the abbey church S. Martin at Laon, although the structure of the church is already Gothic, we see windows that do not entirely abandon Romanesque traditions (16). Round and pointed arches mingle, and the new school only appears in the form of the mouldings. Even here the round arch appears above the pointed arch; which also proves that during the epoch of transition, the architects felt themselves free to adopt either of these arches according to the needs of construction. The lower window is covered by the pointed arch, because this window is wider than the other, and the constructor has wished to give more solidity to its construction by supporting the jambs of the upper window on the spandrels of the arch, whose profile approaches more nearly the horizonta, line. He was e

evidently preoccupied by the effect that might be produced by [illegible] tween the impost and crown; the pointed arch is only a means [illegible] right and left. Do not lose sight of this; about the middle [illegible] number of Romanesque edifices fail, particularly at the time when men had desired to give them very great dimensions, that they must have observed the effects of settlement and rupture produced in these structures, and that they constantly feared [illegible] as they used, as one employs a new procedure recognized as good, i.e., always when they had a doubt of the efficiency of [illegible] ienced, bold and certain of their means of execution, to still employ the round arch for such great spans, as did the architect of Notre Dame of Chartres.

With stone from Berchere, one could be contented with a system of mixed tracery, like that adopted for the high windows of the cathedral of Chartres, i.e., composed of voussoirs forming an elastic and resistant skeleton, and of thin slabs perforated like the closures of various windows; but all materials did not lend themselves to the use of these procedures. In Champagne, although the constructors possessed materials of great dimensions, they did not find in the quarries of the province beds with sufficient resistance to permit the use of this wide tracery composed of slabs. They proceeded differently and made stone sashes to maintain the panels of glass, by means of jointed arches, one placed within the other and independent. This system was complete in the construction of the windows of the chapels of the choir of the cathedral of Rheims, which must have been erected about 1215. Conformably to the method of Champagne, the windows permit enclosures by coined arches, with soffits terminating inside like the axis arch to receive the fillings of the vaults, and bearing the orchestrad moulding on the exterior under which meet two pointed arches of the true window, only resting on these two arches w without interrupting the mouldings of the archivolt. A fig. is necessary to explain this very important construction in which is given to us the transition between the and plate tr-

evidently preoccupied by the effect that might be produced by the jamb of the window on the voussoirs of the round arch between the impost and crown; the pointed arch is only a means of avoiding rupture at the middle parts of the archivolt at right and left. Do not lose sight of this; about the middle of the 12 th century, the architects had seen such a great n number of Romanesque edifices fall, particularly at the time when men had desired to give them very great dimensions, tha t they must have observed the effects of settlement and rupture produced in these structures, and that they constantly feared to see these injurious effects reproduced. The pointed arch was they used, as one employs a new procedure recognized as good, i.e., always when they had a doubt of the efficiency of the old methods. It could only be given to men already experienced, bold and certain of their means of execution, to still employ the round arch for such great spans, as did the architect of Notre Dame of Chartres.

With stone from Berchere, one could be combined with a system of mixed tracery, like that adopted for the high windows of the cathedral of Chartres, i.e., composed of voussoirs forming an elastic and resistant skeleton, and of thin slabs perforated like the closures of antique windows; but all materials did not lend themselves to the use of these procedures. In Champagne, although the constructors possessed materials of great dimensions, they did not find in the quarries of the province beds with sufficient resistance to permit the use of this wide tracery composed of slabs. They proceeded differently and made stone sashes to maintain the panels of glass, by means of jointed arches, one turned within the other and independent. This system was complete in the construction of the windows of the chapels of the choir of the cathedral of Rheims, which must have been erected about 1215. Conformably to the method of Champagne, the windows permit enclosures by pointed arches, wide splays terminating inside like the side arch to receive the fillings of the vaults, and bearing the projecting moulding on the exterior under which meet two pointed arches of the rose window,only resting on these two arches w without intersecting the mouldings of the archivolt. A Fig. is necessary to explain this very important construction in which is given to us the transition between bar and plate tr-

tracery. We give then (17) a perspective sketch of the upper part of [illegible]. One sees at A the side arch-soffit that belongs to the primitive Gothic style of Cathedrals, the side arch whose section is given at B. Beneath this arch-soffit is turned the archivolt C, only containing the section of the little columns D and a double bevel receiving the groove for the glass. At E is the impost, that receives one of the arches resting on the central mullion F. The crown of this arch is then intersected by the rose, that is only placed between the voussoirs of the archivolt C. In its turn the rose receives in a groove the glass H that we not have a groove cut staples inside to maintain the glass panels. We not forget to note that the little columns of the central mullion as well as those of the jambs are not connected to the construction, but are set on end according to the method used for most little columns at the end of the 12 th century. On the exterior these windows give the elevation (17). The archivolt C being a disconnected arch is naturally subject to the settlements and movements suffered by the structure; now the rose being left free and maintained only by friction with the spandrels of the archivolt, does not risk being broken by these settlements; it may be slightly deformed like a ring of iron or wood under pressure, but could not break. There is a mark of foresight acquired by long observation of the effects manifested in such vast structures.

All the windows of the cathedral of Rheims are constructed on this principle. Our elevation (18) indicates at A the section of the upper part of the window, B being the internal arch-soffit. There is seen at C the mode in which are inserted the cusps of the rose, maintained at their ends D by iron ring and the keys E; at G are recesses for the glass set inside. One will note that this rebate in the sill, whose section is traced at I, returns to cast on the external slope K the rain or drip running down the glass. A perspective detail X shows this double arrangement of the recesses. At L we have traced a horizontal section of the mullion and jambs with the projection of the circular wash M; at O the intersection of the bases of the little columns of the jambs and mullions is established on a plane of this wash. (Arts. Chapiteau, Figs. 36, 37).

Since the windows of the cathedral of Rheims are narrow

tracery. We give then (17) a perspective sketch of the upper part of those windows taken from the interior of the chapels. One sees at A the side arch-soffit that belongs to the primitive Gothic style of Champagne, the side arch whose section is given at B. Beneath this arch-soffit is turned the archivolt C, only continuing the section of the little columns D and a double bevel receiving the groove for the glass. At E is the impost, that receives one of the arches resting on the central mullion G. The crown of this arch is then intersected by the rose, that is only placed between the voussoirs of the archivolt C. In its turn the rose receives in a groove the c cusps H that do not have a groove but staples inside to maintain the glass panels. Do not forget to note that the little columns of the central mullion as well as those of the jambs are not connected to the construction, but are set on end according to the method used for most little columns at the end of the 12 th century. On the exterior these windows give the elevation (18). The archivolt C being a discharging arch is naturally subject to the settlements and movements suffered by the structure; now the rose being left free and maintaine d only by friction with the spandrels of the archivolt, does n not risk being broken by these settlements; it may be slightly deformed like a ring of iron or wood under pressure, but could not break. There is a mark of foresight acquired by long observation of the effects manifested in such vast structures.

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Whether the windows of the cathedral of Rheims are narrow

or wide, they only have a central mullion and two openings; it then results that these spaces are either 3.9 or 7.5 ft. wide. To maintain the glass panels in such wide openings were required very strong iron bars. They soon adopted a system of multiplying the mullions for wide windows, so as to have always nearly equal spaces. Instead of a single mullion, there were placed three so as to divide the opening into four parts of equal widths. Only about 1240 occurred this important modification, and thenceforth whenever the nature of the materials permitted, the tracery was only set on end and fixed in a groove under the archivolt. Among the most beautiful and t the first windows of the kind must be mentioned those of the upper S. Chapelle at Paris. One finds there again, Fig. 19, a principle that dominates the construction of the windows of the cathedral of Rheims, i.e., that the openiug is divided into two parts by a vertical mullion A supporting two pointed arches and a rose. But the two large divisions a B are themselves bisected by the secondary mullions C, that also bear pointed arches and smaller roses, so that the spaces to be glazed are only about 3.3 ft. wide. The archivolt D (see section 8) fills in the interior the function of the side arch and receives the fillings of the vault F. The second archivolt G serves as a discharging arch, supports the gutter, the external balustrade and the eave wall H on which rests the carpentry. One sees at I gargoyles with tails penetrating to the haunches of the vaults to cast off rainwater, that fell on these v vaults before the completion of the construction and the placing of the covering. At the S. Chapelle of the palace one s sees originate the gables over the archivolts of the windows; gables that are at the same time a decoration and a means of maintaining the archivolts in their planes. (Art. Construction, Fig. 108). At K we have traced the whole of the window, that has in height three times its width; at L are iron ties that prevent deviation of the buttresses, connect them together and prevent the mullions from leaving their plane. Further this tracery is not cut in courses but in large stones set on edge, that permits less breadth and leaves more space for the glass; as for this, its panels are maintained in the windows of S. Chapelle by bars of wrought iron and by grooves cut at the middle of the thickness of the tracery as indicated at M.

These windows are glazed from inside, and the iron bars project outside the panels, but are set in such a manner as to entirely clear the grooves. The section of the sill is traced at N, these sills always bearing a little shoulder O inside to throw outside rain entering the crevices of the panels. In the windows of the upper S. Chapelle are seen that arches and openings of the tracery are accurately comprised within the h height of the archivolt. This arrangement had one defect, it caused the little columns of the tracery to appear too high, not giving sufficient importance to the upper tracery. The a architects of the middle of the 13 th century observed this bad effect, and they soon lowered the arches of the tracery and the upper openings below the springing of the architraves. But about the end of the first half of the 13 th century, in religious edifices the windows were combined, either with the arcade of the substructure when they were pierced in the ground story, or with open galleries in the second story, when t they opened in the upper part of the high nave. Already at t the upper S. Chapelle of the Palace, the internal arcade serves as a sill for the great windows, like those of the lower chapel. (Art. Arcature, Fig. 8). If in the upper S. Chapelle this arcade cannot be absolutely connected to the tracery of the windows, still the divisions correspond to the spaces of the tracery; the architects thus seemed to desire to make the windows start from the ground, i.e., to compose their edifice only of piers and openings, a portion of which was closed below. This was a means of giving grandeur to the interiors of religious edifices. We have seen that the architects of the churches of Notre Dame of Chalons-sur-Marne and of the choir of S. Remy of Rheims, had sought to connect the upper windows with the triforium. In the cathedral of Rheims this principle was not followed, but we see that in Ile-de-France and Picardy it was freely adopted at least for the upper windows.

The nave of the cathedral of Amiens presents one of the first and most beautiful examples of this system. In that nave the upper windows and the triforium form an entirety, although this triforium is still closed and has a special arrangement. This new method has such importance, and it so clearly indicates the purpose, that the architects proposed to attain, viz:- to entirely suppress the walls, what are termed the hangings

in trade towns, [illegible] [illegible] At A is traced the internal faces of one of these windows. It [illegible] vaults rest on the columns C, and the diagonal arches on the little columns D; the archivolt of the window takes the place of the side arch. Then in this construction are only piers and windows. The triforium is actually connected to that opening, not only by its decoration, but also by its construction. Yet the roof H of the side aisle abutting against that triforium, the partition I closes the gallery, and the discharging arch O bears the upper passage, and forms a strut between the piers that receive the columns of the head N of the flying buttresses. The marble piers P are placed over the crowns of the archivolts of the side aisles, so that all the weight is thrown on the piers of the nave. The visible mullion of the opening is built in thin courses, but already the intermediate tracery is only composed of large slabs of stone set on edge. The bases of the roses, large and small, are inserted in a groove in the uppermost part of the upper tracery. These openings being of considerable dimensions, it was thought proper to suitably tie these openings, to place verticals at the middle of each bay, and to fit the upper rose with a second [illegible] as much to relieve the [illegible] as to resist the weight of the glass panels. If the triforium already here forms a part of the window, yet it is still a distinct architectural member, it is not an opening, and permits to be seen traces of the stone between the archivolt and the sill of the great opening. These dark recesses and plain surfaces below the great glazed parts of the high windows offended the logical minds of the architects of the 13 th century. In fact the triforium was no [illegible] already the substructure of the window, but one was forced to [illegible] it with sufficient intimacy. By arranging the roofs of the side aisles as hip or terrace roofs, men could also make openings in the wall of the triforium; but then it was necessary to omit those solid tympanums and high sills, to decidedly extend the great openings of the naves down to the sill of the gallery, giving it only the solid parts strictly necessary to find a service passage at P. In the angle of the side

in trade terms, that we must give here an illustration of th-ose high windows in the nave of Notre Dame of Amiens. (20). At A is traced the internal faces of one of these windows, at B its section on C C′C″. The transverse arches of the great vaults rest on the columns D, and the diagonal arches on the little columns E; the archivolt of the window takes the place of the side arch. Then in that construction are only piers a and windows. The triforium is actually connected to that open-ing, not only by its decoration, but also by its construction. Yet the roof H of the side aisle abutting against that trifo-rium, the partition I closes the gallery, and the discharging arch O bears the upper passage, and forms a strut between the piers that receive the columns of the head M of the flying b buttress. The middle piers P are placed over the crowns of th the archivolts of the side aisles, so that all the weight is thrown on the piers of the nave. The middle mullion of the o opening is built in high courses, but already the intermediate tracery is only composed of large slabs of stone set on edge. The cusps of the roses, large and small, are inserted in a gr groove in the principal part of the upper tracery.[1] These ope-nings being of considerable dimensions, t was thought proper to multiply the iron crossbars, to place verticals at the mid-dle of each space, and to fit the upper rose with a strong r ring as much to relieve the cusp as to resist the weight of the glass panels. If the triforium already here forms a part of the window, yet it is still a distinct architectural memb-er, it is not an opening, and permits to be seen parts of han-gings between its archivolt and the sill of the great opening. These dark recesses and plain surfaces below the great glazed parts of the high windows plagued the logical minds of the a architects of the 13 th century. In fact the triforium was no longer a closed gallery passing beneath the windows, it was already the substructure of the window, but one not joined to it with sufficient intimacy. In arranging the roofs of the s side aisles as hip or terrace roofs, men could also make open-ings in the wall of the triforium; but then it was necessary to omit those solid tympanums and high sills, to decidedly e extend the great openings of the naves down to the sill of t the gallery, giving it only the solid parts absolutely necess-ary to find a service passage at R. In the choir of the same

cathedral, this new programme was solved with certain experiments; the solid tympanums over the archivolts of the triforium still exist; it was indeed sought to make them lighter by gables with crockets, but the separation between the window and the gallery no less existed (Art. Triforium). In Champagne and Ile-de-France the problem seems to have been solved in an absolute manner for the first time. The nave and the high parts of the choir of the abbey church S. Denis, built about 1245 (20 years after the nave of Notre Dame of Amiens), show us windows only forming a single entirety with the treforium.[1] These windows further present certain spacial arrangements, which have a meaning from the point of view of construction. Let us first indicate this rule to which one finds few exceptions; the tracery of the windows always presents a principal division, so as to furnish two spaces only if these openings are narrow, and two spaces subdivided by secondary mullions if the openings are wider; thus the windows possess spaces in equal numbers, two and four. These divisions are again subdivided if the windows are of extraordinary width to form eight spaces,[2] i.e., the principal mullion, two secondary and four tertiary mullions, in all seven mullions. There is recognized this system of crystallization, let us say, toward which Gothic architecture falls by a fatal descent after the middle of the 13 th century. For example, it is known that the architects having admitted that to maintain the panels of glass, it was no longer necessary to leave more than about 3.3 ft. between the mullions, without being compelled to place iron muntins between these mullions as in the preceding example; that from the moment when these mullions were regarded as stone sashes intended to maintain these panels, it was illogical to double them by vertical bars of iron, and these architects were soon induced to set as many vertical stone mullions with intervals of three ft. to receive the glass. If a window 6.6 ft. wide is to be glazed, the architect places one mullion (21). If it be 13.1 ft., he places one principal and two secondary mullions (22). For 26.3 ft., he places a principal mullion, two secondary and four tertiary mullions (23). But then the rose A and the compartments B become so large, that it is impossible to glaze them without employing very complex iron frames; it is necessary to avoid these. Combinations of stone

cusps are sought to fill these spaces as we have sketched at C, for example. The sash is then complete and iron is merely accessory, only placed in the form of crossbars fitted with loops. We have stated already, that the defect of the high windows of the S. Chapelle of the palace was to present too long mullions for the upper tracery, this not descending below the imposts of the archivolts. The architect of the nave of Notre Dame of Amoens, before the construction of the S. Chapelle, h had already extended the upper tracery below the imposts of the archivolt-side-arches (Fig. 20). But the more the mullions were multiplied, and the lower the tracery extended, as s shown by the two Figs. 21, 22, it was indeed necessary as shown in Fig. 23, to trace inner pointed arches more nearly approaching the round arch than in the other examples.

Note 1.p.389. For details of the construction of this tracery, see Art. Meneau.

Note 1.p.391. Some arrangement in the high part of the choir of the cathedral of Troyes, which seems to precede by some y years the structures of the 13 th century of the church S. Denis. The architecture of Champagne is nearly always in advance of that of the adjacent provinces, and even of Ile-de-France.

Note 2.p.391. We find exceptions to this rule at the end of the 13 th century in the church S. Urbain at Troyes. One sees that it is always Champagne that introduces innovations in a architecture.

The high windows of the nave of Notre Dame of Amiens possess a central mullion showing greater width than the two others. In fact the weight of the tracery rests almost entirely on t that mullion; this had no inconvenience when the central mullion was still composed of courses or high stones, not being of a kind to split. If on the contrary, one desired to make these mullions of long stones that might split, it was a serious danger to transfer the entire load to the central pier. The architects of the churches of S. Denis, the cathedral of Troyes and of some other religious monuments erected at the middle of the 13 th century, retained the general arrangement indicated in Fig. 20, but for greater safety gave an equal section, if not an equal thickness to the three mullions of the great openings; i.e., (Fig. 24) [1] they annexed two windows w with a single mullion in each. Thus all the principal members

of the tracery retained the same width, and the stone each had equal stiffness in all its sections. At A we have indicated the section of the central mullion and of one of the intermediate mullions; at B the section of the window on its axis. Here the cusps of the roses are not set in the groove as at Amiens, but belong to the general stonework; which allows giving them greatest lightness, obtaining more strength and to diminish the strength of the iron bars. As we have just stated, the triforium is intimately connected with the window, opened like it, and the tympanums intended to support the ceiling of the passage C present only plain surfaces of little importance. An external wall D is opened like the gallery E, although similar in outline. To this wall D are attached the panels of glass. The iron bars G form a continuous tie passing through the piers and mullions, and connecting together the entire construction. Soon men desired even to suppress these little solid tympanums above the arch-vaults of the triforium, and to have only tracery without interruption other than the ceiling course between the upper gallery and the window. The windows of the triforium then appeared to be merely a single opening divided by mullions and entirely opened tracery (Art. Triforium). When the bays of the great naves were composed only of the tracery of the triforium and of windows completely the entire space left between the top of the arch-vaults of the aisles and the side vaults. If the sanctuaries had no aisles, these were entirely closed by means of a glazed gallery surmounted by the window occupying the entire space between the piers. This was accomplished in the choir of S. Urbain of Troyes, which presents to the eyes only one splendid lantern of stained glass resting on the closed base, only from 9.8 to 13.1 ft. high.[1]

Note 1.p.383. Upper window of the choir of the abbey church of S. Denis.

Note 1.p.385. Art. Construction, Figs. 102, 104, 105, 106.

We have given in Art. Chapelle, Figs. 4, 5, 6, the arrangement of the windows of the royal chapel of the castle of S. Germain-en-Laye, an arrangement that occupies the entire space between the buttresses of the edifice by isolating the side arches of the vaults, so that on the exterior this chapel allows to be seen only as solid parts these piers and great rec-

of the tracery retained the same width, and the stone sash h had equal stiffness over its entire surface. At A we have traced the section of the central mullion and of one of the intermediate mullions; at B the section of the window on its a axis. Here the cusps of the roses are not set in the groove as at Amiens, but belong to the general stonework; which allows giving them greater lightness, obtaining more strength a and to diminish the strength of the iron bars. As we have just stated, the triforium is intimately connected with the window, opened like it, and the tympanums intended to support the ceiling of the passage C present only plain surfaces of little importance. An external wall D is opened like the gallery E, although simpler in cutting. To this wall D are attached the panels of glass. The iron bars G form a continuous tie passing through the piers and mullions, and connecting together the entire construction. Soon men desired even to suppress these little solid tympanums above the archivolts of the triforium, and to have only tracery without interruption other than the ceiling course between the upper gallery and the window. The windows of the triforium then appeared to be merely a single opening divided by mullions and entirely opened tracery (Art. Triforium). Then the bays of the great naves were composed o only of the arches of the side aislesand of windows comprising the entire space left between the top of the archivolts of these bays and the high vaults. If the sanctuaries had side aisles, these were entirely opened by means of the glazed g gallery surmounted by the window comprising the entire space between the piers. Thus was constructed the choir of S. Urbain of Troyes, which presents to the eyes only the splendid l lantern of stained glass resting on the closed base, only from 9.8 to 13.1 ft. high.[1]

Note 1.p.393. Upper window of the choir of the obbey church of S. Denis.

Note 1.p.395. Art. Construction, Figs. 103, 104, 105, 106.

We have given in Art. Chapelle, Figs. 4, 5, 6, the arrangement of the windows of the royal chapel of the castle of S. Germain-en-Laye, an arrangement that opens the entire space b between the buttresses of the edifice by isolating the side arches of the vault, so that on the extérior this chapel allows to be seen only as solid parts great piers and great rec-

rectangular tracery windows. This tendency to leave entirely open the walls of religious edifices between the buttresses, to only construct piers supporting vaults with translucent o ornamentation instead of walls, is evidently the preoccupation of architects from the middle of the 13 th century. From the moment that were adopted colored glass windows, mural painting could produce but slight effect in interiors, because of the lack of white light and the brilliancy of the glass; then was adopted the system of having only translucent painting, to which was given the greatest area possible.

Champagne precedes the other provinces of France, when it became necessary to adopt that system. The side aisles of the nave of S. Urbain of Troyes, whose construction dates from t the end of the 13 th century, present between the buttresses that arrangement of rectangular windows, very rich and independent of the vaults. The architect of this curious church, desiring to adopt the broad scheme in a little edifice, that cannot be praised too much, divided his nave in only three bays. The side aisles are covered by cross vaults on square plans; but as the spaces between the buttresses would have been too wide to open a single window between the piers, except by g giving it a width greater than its height, which would have produced a very disagreeable effect, or to leave between the openings and the piers wide piers, that he wished to avoid, t this architect then divided each (Fig. 25) bay of the side a aisle by a rib A, that springs from the pier and buttress B smaller than the buttress C, which receives the flying buttress. In the spaces left between the large and small buttresses he opened windows D, ending rectangularly beneath the gutter, a and independent of the side arches of the vaults. But he has desired to give to the exterior as to the interior great richness in these windows. Fig. 26 presents the external elevation of one of these openings at the scale of 1 y 50. At A is one of the great buttresses and at B one of the small ones. T The section E is made through the balustrade at E'. The course forming the gutter resting on the tracery is at G. The section C at 1 : 25 is made across the mullion at the height H, and t that at D across the same mullion is at the height I. The glass is set in the grooves K. If we make a section on the axis of that window (Fig. 27), we have the central mullion at A, the

little buttress at B, and at C beneath the side arch of the vault is tracery, that is merely a decoration. One sees that the gutter G rests on this side arch and on the external tracery. Let us examine this window from the interior of the side aisle, Fig. 28. At A we ha:e indicated the glazed tracery, the window that supports the gutter G, and that is accurately comprised between the buttresses; at B is traced the internal tracery beneath the side arch C of the vault. By the jointing, that is accurately traced, it is recognized, that this tracery is completely independent of the construction of the buttress, that it is merely perforated slabs cut in an excellent lias from Tonnerre. The construction thus only consists of b buttresses or piers supporting the vaults; then as the enclosure there are only perforated walls placed outside the receiving gutter. These are actual frames set later, to be changed, repaired or replaced without touching the edifice. There is no need to emphasize the advantages that result from this system, perfectly reasoned, that allows the richest and the lightest decoration without loss of solidity and simplicity of the structure.

Yet during the 14 th century was abandoned, even in Champagne, this system of windows inscribed in rectangular forms for religious edifices, and men returned to taking the side arches of the vaults as archivolts of the openings; but the tracery became gradually more delicate, arriving at sections of extreme delicacy in order to leave to the glass, i.e., the colored ornamental surfaces possible. (Art. Meneau).

FENETRES APPARTENANT A L'ARCHITECTURE CIVILE ET MILITAIRE.
Windows belonging to Civil and Military Architecture.

In antique Greek and Roman architecture, the internal structure of the interior to be lighted determines the form and dimensions of the windows. The same principle is applied with still more rigor by the architects of the middle ages. If the arched for is suited to openings with fixed glass, and that are inscribed by vaults, it will be agreed that this form can scarcely be applied to openings, that must be opened frequently, and that are made between floors. As we stated in commencing this Article, the windows in the first centuries of the middle ages very rarely were glazed in public edifices; but it was indeed necessary in private habitations to protect per-

persons from cold and wind, even if only during the night; b then these windows were closed by wooden shutters; when air [illegible] iences of this primitive mode soon compelled the architects to pierce some holes in these shutters, that were covered by [illegible] glass, paper, parchment or linen.

Some windows of habitations of the 11 th century, for example like those of our old Norman keeps, permit no trace of an old closure to be seen; so it is to be believed that they were closed by mats, curtains of wool or coarse linen; indeed one [illegible] of documents fitted with these movable curtains sliding on rods, and held by loops when it is desired to cause air and light to enter interiors. Certainly urban habitations, those of citizens devoted to any work in the interiors of their houses, already had windows, glazed or covered by parchment, while castles still retained the ancient customs, for the feudal lords and their men only assembled in the evenings in their lodgings to eat and sleep; they had no inside work, and passed nearly all their days in riding over the country.

In the houses of cities, the need of introducing light into interiors (streets were generally narrow) was the motive of those fixed colonnades, that we find in nearly all French habitations after the 12 th century. The work of M.A.Verdier & Cattois on the civil architecture of the middle ages furnishes us with a great number of examples of these continuous windows, that occupy the entire side of the principal room in the second and even third stories, a room that served as a place for work and assemblage for the entire family. But these cannot be regarded as windows, properly speaking; we shall have occasion to describe them in Art. Maison.

The Romanesque civil window is usually narrow, composed of two jambs covered by a jointed arch or cut in a lintel with a discharging arch behind it, or a second lintel presenting a course sufficiently strong to receive the beams of the floor. Sometimes the window is nothing but an arched opening, like those presented in Figs. 1 and 2. Yet these openings (because of the arch terminating them) were closed with difficulty by blinds, as these could not be developed under the arch; the

persons from cold and wind, even if only during the night; t then these windows were closed by wooden shutters; when air and light were desired, the shutters were opened. The inconveniences of this primitive mode soon compelled the architects to pierce some holes in these shutters, that were covered by glass or parchment. Then they came to make wooden sashes receiving glass, paper, parchment or linen.

Some windows of habitations of the 11 th century, for example like those of our old Norman keeps, permit no trace of an old closure to be seen; it is to be believed that they were closed by mats, curtains of wool or coarse linen; indeed one frequently sees in Carlovingian manuscripts representations of openings fitted with these movable curtains sliding on rods, and held by loops when it is desired to cause air and light to enter interiors. Certainly urban habitations, those of citizens devoted to any work in the interiors of their houses, already had windows, glazed or covered by parchment, while castles still retained the ancient customs, for the feudal lords and their men only assembled in the evenings in their lodgings to eat and sleep; they had no inside work, and passed nearly all their days in riding over the country.

In the houses of cities, the need of introducing light into interiors (streets were generally narrow) was the motive of those glazed colonnades, that we find in nearly all French habitations after the 12 th century. The work of M.M.Verdier & Cattoison the civil architecture of the middle ages furnishes us with a great number of examples of those continuous windows, that occupy the entire side of the principal room in the second and even third stories, a room that served as a palce for work and assemblage for the entire family. But these cannot be regarded as windows, properly speaking; we shall have occasion to describe them in Art. Maison.

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use of this method was soon renounced, the openings were enlarged and divided by a mullion or little column. Fig. 29 shows us the Romanesque window of the end of the 11 th century, that by the preservation of all its accessories supplies a remarkable example of the system of closure generally adopted at th that epoch. It comes from the castle of Carcassonne.[1] At A is traced the plan. Its total width between the inside jambs is 3.9 ft., and the depth of the recess is 1.95 ft., half the w width. The little white marbel column supports the external lintel cut out in two arches. (See the ekternal front of the opening at B). This lintel I is doubled inside by a second lintel K and a third lintel L (see section C), that is made of a block of concrete [2] that receives the beams of the floor. Two hinge pins G are still in place (see inner elevation D), and received a divided shutter, that when opened swung against the jamb and wall as indicated by the plan. When it was desired to close the window, the two leaves of the shutter were closed and a wooden bar was drawn out, whose place is indicated on the plan and the sketch D at F, until the end of the bar entered the hole P.[3] The sill of the window formed a bench in the interior of the room.

Note 1.p.401. Inner facade of the gate tower.

Note 2.p.401. See Art. Beton, Fig. 1.

Note 3.p.401. See Art. Barre for means of drawing this sort of closure.

We give (30) the internal elevation of this shutter at O, and its section on a b at M; the drawn bar is indicated at R. Openings glazed by pieces of glass set in lead admitted light into the room when the blinds were closed. The hinges were d divided like shutters, as indicated in our Fig. Here the height between the floors was too small to allow the use of the internal discharging arch; but generally the inside of Romanesque windows divided by a little column is surmounted by a round discharging arch.

Here (31) is one of the windows of the keep of Falaise, whose construction dates from nearly the same epoch. The plan A shows us that the opening really consists of a loggia or round arcade, externally closed by a sill wall, a little column and two reveals. On the exterior (see sketch B) the window d does not show the round arch of the inside recess, but only

[illegible]

of the external wall. These windows seem not to have been originally closed by shutters, but as we have just stated, by nets or hangings suspended beneath the great arch. A little later we note that in these Roman castles are used solid wooden shutters to close openings, allowing the great span of the recess to appear externally, and opening a transom under the arch.

Thus are constructed some windows of the castle [illegible] of [illegible] of the 12 th century. Fig. [illegible] explains this arrangement. Section A shows the exterior of the window, and B is the section. Under the round barrel vault E of the recess is turned the arch D, whose imposts rest on the ends of a lintel C and on two jambs. A mullion receives this lintel at the middle of its span. The space between the lintel C and arch D was permanently glazed, and solid shutters, divided and hinged, closed the openings under the lintel. Later when the openings of the windows were glazed, there was still retained the fixed transom above the opened portion. This we did to realize in France until our days, since in many habitations of the last (18 th) century are still seen windows with transoms. Frequently indeed, in fact, when one desires to look out of a window, it is very inconvenient to open a sash 7.5 or 12.1 ft. high, often difficult to move it when its frames has swelled or dried and warped it, and that allows the entrance of a volume of air much greater than necessary. It must also be said that rooms intended for habitation being much larger than those of our apartments, they did not feel the necessity for renewing the internal air so frequently as today. The wide fireplaces caused a sufficient draft for the external air in winter, so that it was unnecessary to open the windows; and in summer a coolness was obtained by keeping them closed. It was only when one desired to look into the street, that one half opened a small opening sash, allowing one or at most two persons to lean over the sill. Yet in the 13 th century were retained bars placed in the thickness of the walls and drawn behind the shutters, and instead of solid shutters or those pierced

the two little arches resting on the little column. Internally (see sketch D) one notes that the window offers a recess from which by advancing to the sill C, one can see the foot of the external wall. These windows seem not to have been originally closed by shutters, but as we have just stated, by mats or hangings suspended beneath the great arch. A little later we note that in these Norman castles are used solid w wooden shutters to close openings, allowing the great arch of the recess to appear externally, and opening a transom beneath the arch.

Thus are constructed some windows of the castle of Harcourt at Lillebonne and of several other Norman castles of the 12 th century. Fig. 32 explains that arrangement. Sketch A shows us the exterior of the window, and B is its section. Under t the round tunnel vault E of the recess is turned the arch D, whose imposts rest on the ends of a lintel C and on two jambs. A mullion relieves this lintel at the middle of its span. The space between the lintel C and arch D was permanently glazed, and solid shutters, divided and barred, closed the opening b behind the mullion. Later when the closures of the windows w were glazed, there was still retained the fixed transom above the opened portion. This tradition remains in France until o our days, since in many habitations of the last (18 th) century are still seen windows with impost lights, frequently fixed. In fact, when one desires to look out of a window, it is very inconvenient to open a sash 9.8 or 13.1 ft. high, olten difficult to move it when dampness has swelled or dryness has shrunk it, and that allows the passage in winter of a volume of air much greater than necessary. It must also be said that rooms intended for habitation being much larger than those of our apartments, they did not feel the necessity for renewing the internal air so freouently as today. The wide fireplaces caused a sufficient draft for the external air in winter, so that it was unnecessary to open the windows; and in summer a coolness was obtained by keeping them closed. It was only when one desired to look into the street, that one half opened a small opening sash, allowing one or at most two persons to lean over the sill. Yet in the 13 th century were renounced bars placed in the thickness of the walls and drawn behind the shutters, and instead of solid shutters or those pierced

[illegible]

citadel of Verdun. This is still the Romanesque system. The lintel is relieved by the pointed vault of the recess that appears externally, and is pierced by a quatrefoil permanently glazed; but the two windows are fitted with glazed sashes made on a single plan fixed in rabbets, held beside the mullion by bolts sliding into the stone projection P, reserved inside the mullion. The inventive minds of the lay architects of the 13 th century invented novel and very varied arrangements for the windows of civil and residence buildings. We even find that in certain cases they retained the pure Romanesque tradition, i. e., they opened in the wall the round arch, and placed a lintel below this centre to receive a rectangular sash, as in a turret belonging to the dragon's palace of Soissons (24); (beginning of the 13 th century); or indeed for small rooms they adopted openings wide in comparison to their height, separated by an elegant central mullion externally covered by a lintel decorated by arches, and internally formed a recess covered by a discharging barrel vault, and furnished with a bench B (25).[1] Here the mullion is reinforced internally by a brace A serving as an arm, and receiving the bolts for closing the two sashes. (Art. Sash, Fig. 1). We likewise see that to light rooms quite high between floors, they arranged windows so as not to be able to open at one time but a part of their area; then the central mullion is divided by a transom bar (26), and the opening has four movable sashes, the lower opening to look outside, and the upper to admit light into the upper part of the room, always with projections on the mullion to receive the bolts.[2]

Note 1.p.407. From a house of Flavigny.

Note 2.p.407. From a house of Flavigny, middle of 13 th cent.

Still were required from architects about the middle of the 13 th century larger windows to light houses or public edifices; as manners became more refined, men desired more open houses, and not walled like fortresses. Especially in the cities of Ile-de-France and of Champagne was perceived in the reign of S. Louis a tendency toward those needs of modern civilization.

by small openingswere established entirely glazed wooden sashes.

Here (33) is one of the windows of the beginning of the 13 th century, pierced in the old buildings now depending on the c citadel of Verdun. This is still the Romanesque system. The lintel is relieved by the pointed vault of the recess that appears externally, and is pierced by a quatrefoil permanently glazed; but the two windows are fitted with glazed sashes hung on hinge pins fixed in rebates, held beside the mullion by bolts sliding into the stone projection B, reserved inside t the mullion. The ingenious minds of the lay architects of the 13 th century invented novel and very varied arrangements for the windows of civil and residence buildings. We seen that in certain cases they retained the pure Romanesque tradition, i. e., they opened in the wall the round arch, and placed a lintel below this centre to receive a rectangular sash, as in a turret belonging to the bishop's palace of Soissons (34); (beginning of the 13 th century); or indeed for small rooms they adopted openings wide in comparison to their height, separated by an elegant central mullionexternally covered by a lintel decorated by arches, and internally forming a recess covered by a discharging tunnel vault, and furnished with a bench B (35).[1] Here the mullion is reinforced internally by a brace A serving as an arm, and receiving the bolts for closing the two sashes. (Art. Banc, Fig. 4). We likewise see that to light rooms quite high between floors, they arranged windows so as not to be ab able to open at one time but a part of their area; then the c central mullion is divided by a transom bar (36), and the opening has four movable sashes, the lower opening to look outside, and the upper to admit light into the upper part of the room, always with projections on the mullion to receive the bolts.[2]

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There still exists at Rheims the facade of a house quite c
complete on Rue du Tambour, the house called that of the Musi-
cians (Art. Maison), which dates from about 1240. The rooms
of the second story are lighted by wide and high windows (37),
whose elevation we give at A, at B being the internal elevat-
ion, and at C the section. The cornice D of the house is set
directly on the lintels of these windows, behind which are t
turned relieving arches E, that bear the carpentry of the roof.
The mullions are so arranged as to receive glazed sashes with-
out the aid of any ironwork. First at G is set under the rel-
ieving arch an oak lintel with holes at its ends corresponding
to the circular projections F made at the two ends of the st-
one cross-bar H. These projections, whose perspective detail
is drawn at I, receive the pivots K of the lower and upper s
sashes. Other like projections O from the sill P receive the
bottom pivots of these lower sashes. The bolts of the four s
sashes enter the projections R left inside the central mulli-
on. We give at a scale of 1 : 10 the section of the mullion
at L, at M the side of one of the projections, and at N its
inside face. [1]

Note 1.p.409. See Architecture Civile of MM. Verdier & Cat-
tois. The House of the Musicians is given in that work with
most of the details of the facade on Rue du Tambour.

These examples emphasize the care that the architects of
that epoch took in the study of the minute details of domest-
ic architecture. All was foreseen during the construction, a
and all was provided with economy. They avoided those iron
fastenings, which after the completion of the dressing of the
facade defaced them by intersecting the mouldings, injuring
the jambs and mutilating the panels and sills; which required
that patching with plaster soon destroyed by time, and thus
accenting the little harmony that exists in our edifices bet-
ween the appearance and needs. In Gothic houses, now regarded
as habitations foreign to our civilization, the windows, like
the other architectural members, are not imitated from the a
antique or the Italian Renaissance; but they are arranged and
made to give air and light, they are proportioned to the roo-
ms, and comprise in their construction all accessories indis-
pensable for opening the movable sashes as well as closing t
them. We might then find here some good instruction, if we

would become acquainted with those simple means, with that c [illegible] the contrary aids them.

But the examples that we have just given here least are taken from private edifices; yet the architects of the middle ages erected vast halls devoted to civil services, or that combined both a religious and civil character. Such were the halls of synods, great interiors destined for great assemblies, where it was necessary to find air, light and grand arrangements; in brief, what is required in our halls and courts. One yet sees near the cathedral of Sens one of those halls, formerly dependent on the archepiscopal palace.

About 1245 under King S. Louis was built the hall of the synod of Sens. On the public place and facing west, it is lighted by windows, admirable in style of the architecture, perfectly appropriate for their purpose and with construction showing the hand of a master. We give (28) the exterior of these windows. The hall being vaulted, the archivolts of the opening are concentric with the side arches of the vaults, and are arranged according to the system of Champagne. The glass comprised in the tracery A is fixed, as in the windows of religious edifices; but the open lights B are rectangular and filled with movable sashes, so as to provide openings within the wall to give air and to look outside. In the interior these windows present the perspective shown (29). This constitut- al construction is repeated at the northern end of the hall, but with four bays instead of two; the frames under openings [illegible] that the builders are furnished with projections intended to receive several bolts in the rebate of the opening sashes, so as to prevent the chafing of these sashes.[1] One will note how the jointing of these traceries is well arranged to present great stability and to avoid crevices. The bases of the ribs (Fig. 29) are set in the rebates, and the lintels of the opening portions are relieved by two strong archivolts, that rest on the strong middle mullion. These windows have a particular character, that does not belong to the style of religious architecture, although they are placed under vaults like the w [illegible] and 14 th centuries did not employ this system of fixed glazed

would become acquainted with those simple means, with that c care in everything which nowise excludes improvements, but on the contrary aids them.

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tracery with opening sashes merely in great halls. We see windows of moderate dimensions so arranged in habitations; the t two volumes on Architecture civile et domestique by MM. Verdier & Cattois,[1], supply us numerous examples, tlthough they have not been able to collect all.

Note 1.p.411. The restoration of this admirable hall, mutilated by time and the neglect of past centuries, was undertaken by the care of the minister of State. The government appreciated all the importance of this monument now unique in France, and that furnishes an example from which can be derived the most useful information for the construction of our great halls for large assemblies. The building was sold during the r revolution, and was purchased by the ministry of public instruction and worship. Thus it now belongs to the State. The preservation of the synod hall of Sens will be a fact the more remarkable, that the administration had to struggle against certain men, for whom every expense not presenting a character of material utility, immediate and local, is a lost expense; but in France we cannot restrict ourselves to erecting markets, abattoirs and hospitals and viaducts. It must be recognized, that at Sens as at Pont-du-Gard and Carcassonne, the enlightened persistence of the administration daily finds the most vivid approbation of numerous visitors among us, who happily think that the monuments of the past merit being preserved a and drawn forth from oblivion in which they were formerly left.

Note 1.p.414. Two volumes in quarto. 1855.

There exists in the second story of gate Narbonne at Carcassonne, built about 1285, a hall of moderate height between floors, lighted from the side next the city by openings presenting a miniature of the windows of the great hall of Sens. The upper part of these openings (40) received fixed sashes. In the interior behind the cross-bar A was placed a wooden bar, (see section C), against which shut in a rebate two opening sashes. A wooden muntin was held by a joint in that bar and a pin in the projection D, was placed behind the mullion and had projections receiving the bolts of the opening sashes. These opening sashes not having water outlets, and not covering the sill E (see detail G), but shutting against the inside of that sill at H, the rain entering between the glass must necessarily run inside. To avoid that inconvenience, the con-

constructor cut at F little gutters with two holes K by which the water passed outside. The opening sashes were held in the rebate by hing pins and straps. The elevation I shows the exterior of the window. The upper tracery is moulded inside the same as outside, since the glass is set at the middle of the thickness of the stone as indicated by our section, while the jambs, mullion and transom bar are cut square inside to receive the sashes and joinery as indicated by our plan.

The forms of the windows opened in civil edifices and the h houses of the 13 th and 14 th centuries are too varied for us to present to our readers a specimen of each sort of these o openings. Always the dimensions or the nature of the halls determined the arrangement, heights and widths of these openings; which was reasonable. That mode of procedure gave architects more trouble, than they take today, when the same window serves for an entire storw of a palace or house, whether that story comprises great halls and little rooms, or it contains stairways and mezzanines.

Still about the end of the 14 th century the customs of the lords and citizens were much softened, and it was found that the opening sashes set in rebates in the stone itself without fixed sashes admitted the cold air from outside; then they t thought to make the wooden sashes independent of the stonework, i.e., the mullions and transom bars. The castle of Pierrefonds was built in 1400 and supplies us with beautiful examples of windows arranged with fixed wooden sashes set in rebates in the stone, and receiving movable glazed sashes and internal shutters.

Fig. 41 gives at A the plan of one of these openings, at B ist external elevation, and at C its internal elevation. On this last drawing, in which we have indicated the opening with its shutters at D, with its glazed sashes at F, omitting the joinery, one sees that the movable sashes as well as the shutter are hinged, not to the stone but to fixed frames set in the wide rebates of the jambs, mullion and transom bar; th that one can open separately each shutter and each glazed sash, which for great windows presents advantages: that the shutters are more or less opened to allow the external light to illuminate the little chambers when these shutters are closed; that these openings close as well as ours if not better, that they

[illegible]

As always, when the walls are quite thick, benches occupy the recesses so as to be able to sit near the window and breathe at ease.

Windows of the civil architecture of the 15 th century conform to these general methods and receive fixed sashes; their mouldings become more complicated on the exterior, and mullions and transoms are thinner to allow passage of more light; their lintels are ornamented as well as their sills, they are enriched by sculpture, and the end of the 15 th century has left us a number of windows with mullions of a delicacy of work, that none equals what was done in the 16 th century or in the epoch of the Renaissance. We shall terminate this article by giving one of the windows of the second story of mansion de la Tremoille at Paris.[1] These windows (49) rest on a solid pierced balustrade forming the sill; their lintels are placed at the level of the cornice of the building, that receives the gutter and roof. Probably finding that this mode of terminating the opening was poor, the architect judged it proper to erect over these lintels a rich decoration in openwork stone, that forms a sort of crown for the windows, and [illegible] the [illegible] of the roof. The [illegible] itself [illegible] at a good height, and bears a [illegible] above each one. Personally (and [illegible] justified by the [illegible]) these crowns of windows placed on the cornice are only [illegible], that [illegible] above. Thus terminate the windows of the palace of [illegible] of Rouen, which are the richest of this kind in France in construction, and more surprising in execution and workmanship. (Art. Lucarne).

Note 1.p.1?. This mansion was demolished in 1841. We possess a complete monograph of it (see Architecture civile et domestique of MM. Verdier & Cattois. Vol. 2).

The mullions and transom bars persist in the windows of French civil architecture until the beginning of the 17 th century, because until then the sashes were in small parts, and men did not suppose it would be convenient to [illegible]

can be made airtight, and that by means of those separate sashes, one can give interiors more or less air and light. All that has been replaced now by casement windows, but we have not yet replaced those shutters opening in small sections. As always, when the walls are quite thick, benches occupy the recesses so as to be able to sit near the window and breathe at ease.

Windows of the civil architecture of the 15 th century conform to these general methods and receive fixed sashes; their mouldings become more complicated on the exterior, and mullions and transom bars thinner to allow passage of more light; t their lintels are ornamented as well as their sills, they are enriched by sculptures, and the end of the 15 th century has left us a number of windows with mullions of a delicacy of w work, that much excels what was done in the 14 th century or in the epoch of the Renaissance. We shall terminate this Article by giving one of the windows of the second story of mansion de la Tremoille at Paris.[1] These windows (42) rest on a solid continuous balustrade forming the sill; their lintels are placed at the level of the cornice of the building, that receives the gutter and roof. Probably finding that this mode of terminating the opening was poor, the architect judged it proper to erect over these lintels a high decoration in perforated stone, that forms a sort of crown for the window, and that intersects the monotonous mass of the roof. The gutter t thus finds itself stopped at each opening, and bears a projecting lead gargoyle above each pier. Frequently (and that was justified by the need) these crowns of openings placed on the cornice are only great stone dormers, that light the attic s story. Thus terminate the windows of the palace of justice of Rouen, which are the richest of this kind in France in combination, and more surprising in stonecutting and workmanship. (Art. Lucarne).

Note 1.p.416. This mansion was demolished in 1841. We possess a complete monograph of it (see Architecture Civile et Domestique of MM. Verdier & Cattois. Vol. 2).

The mullions and transom bars persist in the windows of French civil architecture until the beginning of the 17 th century, because until then the sashes open in small parts, and men did not suppose it would be convenient to handle sashes

and quarters 9.9 ft. high. Du Cerceau shows us again the win-dows of the Louvre of Francis I and of Henry II with cross mullions. Mullions also were in the openings of the palace of the Tuileries. The omission of these accessories, recognized as necessary under the reign of Louis XIV, entirely changed the character of this architecture by reducing its scale; divisions in ironwork do not have the monumental appearance of stone mullions, although giving more light for the interior of the apartments. (Gwilt. Wilson, [illegible]).

Ferme. Farm Buildings. Barns and Sheds.

Rural structures designed for the cultivation of the domain. The Romans were great lovers of rural establishments, and in the vicinity of their villas, sometimes even within their enclosure, they possessed buildings intended to preserve harvests, lodge colonists and enclose animals. The Frankish chiefs appear to have desired to adopt these habits, when they took possession of the soil of Gaul; but their scorn for manual labor and of those engaged in it, their taste for arms and a life of adventure rarely allowed them to occupy themselves with the details of a country life. If they caused to be erected in their villas storehouses of grain, wine, forage and products of all sorts, this was to consume them with their companions in arms, and to waste in some months of orgies the harvest of a year. One understands that these customs were little suited to encourage agriculture and establishment of buildings intended for systematic cultivation.

From the beginning of the 11th century the Benedictines already seriously occupied themselves with agriculture on a great scale. They built barns, cellars, presses and stables, they executed important works of irrigation, and applied themselves to improve the lands, clear the forests and collect numerous herds. In truth, even the first monasteries built by the Cluniacs more nearly resembled what we call a farm today

Later orders, the nobles and commoners, caused the establishment of farms according to the arrangements adopted in our days, and we see that in 1294 a canon of Notre Dame of Paris agreed to build within one year a barn to revert to the chapter after his death. "The canon or heir of the barn must be

and shutters 9.8 ft. high. Du Cerceau shows us again the windows of the Louvre of Francis I and of Henry II with stone mullions. Mullions also were in the openings of the palace of the Tuileries. The omission of these accessories, recognized as necessary under the reighn of Louis XIV, entirely changed the character of this architecture by reducing its scale; divisions in joinery do not have the monumental appearance of stone mullions, without giving more light for the interior of the apartments. (Arts. Maison, Palais).

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Rural structures designed for the cultivation of the domain. The Romans were great lovers of rural establishments, and in the vicinity of their villas, sometimes even within their enclosure, they possessed buildings indended to preserve harvests, lodge colonists and enclose animals. The Frankish chiefs appear to have desired to adopt these habits, when they took possession of the soil of Gaul; but their scorn for manual l labor and of those engaged therein, their taste for arms and a life of adventure raraly allowed them to occupy themselves with the details of a country life. If they caused to be stored in their villas abundance of grain, wine, forage and products of all sorts, this was to consume them with their companions in arms, and to waste in some nights of orgies the harvest of a year. One understands that those customs were unsuited to encourage agriculture and establishment of buildings intended for systematic cultivation.

About the beginning of the 11 th century the monasteries a already seriously occupied themselves with agriculture on a great scale. They built barns, cellars, presses and stables, they executed important works of irrigation, and applied themselves to improve the lands, clear the forests and collect n numerous herds. In truth, even the first monasteries built by the Cluniacs more nearly resembled what we call a farm today than anything else. (Art. Architecture Monastique).

Later monks, lay nobles and chapters, caused the establishment of farms according to the arrangements adopted in our d days, and we see that in 1234 a canon of Notre Dame of Paris agreed to build within one year a barn to revert to the chapter after his death. "The court or yard of the barn must be

2-6 ft. in length and 1[illegible] ft. in width; the enclosing wall to be 18 ft. high not including the coping. In this wall must be made a gate with a tower, and over the gate of the tower must be built vast and substantial granaries; this was properly the barn. It must have at least 128 ft. length and about 37.5 ft. width, with gables at the height of 12 ft. Over the gate a shed of 64 or 77 ft. was intended for the cultivation. On the rear gable must be built a turret sufficiently large to contain a bed and a stove. There must be used for the construction of the turret good oak wood, first and second, and good tiles. The angles of the walls as well as the gate must be of cut stone. Finally there must be built a great and good oven covered by a good and roof of tiles." There still exists in Beauvoisis, Soissonnais, the vicinity of Paris and Toraine, quite a large number of these farm buildings of the 12th and 13th centuries, notably very beautiful barns (Arts. Grange), and dovecotes (Arts. Colombier), which have almost always belonged to religious establishments. As for the general arrangement of farm buildings, it is subordinated to the site, particular needs, and circumstances. It is never more than a collection of separate buildings enclosed by walls and often by ditches. When certain of these farm buildings were fortified, the enclosing walls became [illegible] towers. One still sees some of this sort in Brittany, Savoie, Lyonnais and Poitou.

FERME. Truss. Roof Truss.

A carpentry term. By it is understood every carpentry member that forms a series of bays. One may say roof truss, scaffold truss. (Arts. Charpente, Echafaud).

[illegible]

[illegible]

FEUILLURE. Rebate.

A rebate formed in the jamb of a door or window to receive the leaves or sashes. (Arts. Fenêtre, Porte). Permanent sashes also have rebates, when they receive movable sashes. (Art. [illegible])

256 ft. in length and 192 ft. in width; the enclosing wall to be 18 ft. high not including the coping. In this wall must be made a gate with a postern, and over the door of the postern must be built vast and substantial granaries; this was properly the barn. It must have at least 128 ft. length and about 57.5 ft. width, with gutter at the height of 12 ft. Near the gate a shed of 64 or 77 ft. was intended for the habitation. On the rear gable must be built a turret sufficiently large to contain a bed and stairs. There must be used for the construction of the turret good oak wood, great and strong, and good tiles. The angles of the walls as well as the gate must be of cut stone. Finally there must be built a great and good press covered by a good shed roof of tiles."[1] There still exists in Beauvoisois, Soissonais, the vicinity of Paris and Touraine, guite a large number of these farm buildings of the 12 th and 13 th centuries,[2] notably very beautiful barns (Art. Grange), and dovecots (Art. Colombier), which have almost always belonged to religious establishments. As for the general arrangement of farm buildings, it is subordinate to the site, particular needs, and orientation. It is never more than a collection of separate buildings enclosed by walls and oftey by ditches. Even sometimes these farm buildings were fortified; the enclosing walls having watch-towers and turrets. One still sees some of this sort in Burgundy, Auxois, Lyonneis and Poitou.

FERME. Truss. Roof Truss.

A carpentry term. By it is understood every carpentry member that forms a series of bays. Men say roof truss, scaffold truss. (Arts. Charpente, Echafaud).

FERMETURE. Fastening.

(Arts. Barre, Fenetre, Porte, Serrurie.

FERRURE. Ironwork.

(Arts. Armature, Serrurie.

FEUILLURE. Rebate.

A recess formed in the jamb of a door or window to receive the leaves or sashes. (Arts. Fenetre, Porte). Permanent sashes also have rebates, when they receive movable sashes. (Art. Menuiserie).

[illegible]

[illegible]. Pointing Stone Masonry.

Act of pointing joints in stone masonry.

[illegible]. To point Stone Masonry.

To point the stone is to introduce mortar under its bed when that stone is set on slips. Usually during the middle ages stones were not so set, but were set on a bed of mortar, which is much preferable, for it is difficult, when a stone is set on slips, to introduce mortar in its bed joints, and especially to compress that mortar so as to avoid settlements. However when one proceeds by underpinning and facing, it is [illegible] to set the stones on a bed of mortar; in both cases to avoid the [illegible] of the bed of mortar and to compress it, when this mortar begins to set, it is well to force it back with an iron blade and a mallet. To point stone is employed a tool called a [illegible], the iron blade has saw teeth and a wooden handle; this blade is straight (1) or bent (1 bis). [illegible] One prepares a wooden board fitted with two iron points [illegible] at the level of the stone to be pointed, the ends [illegible] the joint. A tender places the mortar on this board, that the pointer with his trowel and [illegible] forces under the block. When the mortar refuses to enter and comes out on the other bed of the stone, the stone is well pointed and lifted [illegible] its base. Then after this mortar has acquired consistency, it is driven with the iron-tool (2). It is well to leave [illegible] the bed next the face. This piece is called [illegible] by [illegible]. This is a means of [illegible] that the stone is set on its beds, and that it will not [illegible] the load.

[illegible].

This name is given to a projection of the stone intended to [illegible] from the surfaces [illegible] between the mortar and the masonry. A covering of metal, slates or tiles, cannot adhere to the stone, there always remains a [illegible] between this covering and the construction of stone [illegible] it. If this joint, necessarily [illegible], be [illegible] the water, [illegible] the floors and [illegible] to decay. [illegible] [illegible] in the [illegible] above the roofing, or more

FICHAGE. Pointing Stone Masonry.
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To point the stone is to introduce mortar under its bed when that stone is set on slips. Usually during the middle ages stones were not pointed, but were set on a bed of mortar, which is much preferaple, for it is difficult, when a stone is set on slips, to introduce mortar in its bed joints, and especially to compress that mortar so as to avoid settlements. However when one proceeds by underpinning and facing, it is impossible to set the stones on a bed of mortar; in that case to a avoid the shrinkage of the bed of mortar and to compress it, when this mortar begins to set, it is well to force it back with an iron blade and a mallet. To point stones is employed a tool called a jointer, its iron blade has saw teeth and a wooden handle; this blade is straight (1) or bent (1 bis). O One attaches a wooden board fitted with two iron angles C and points B at the level of the stone to be pointed; the ends B entering the joint. A tender places the mortar on this board, that the pointer with his trowel and jointer forces under the block. When the mortar refuses to enter and comes out on the upper bed of the stone, the stone is well jointed and liffed around its back. Then after this mortar has acquired consistency, it is driven with the iron tool (2). It is well to leave an inch open under the bed next the face. This space is filled later by repointing, this is a means of certainty that the stone is set on its edges, and that it will not spall under the load.

FILET. Fillet.
This name is given to a projection of the stone designed to prevent rainwater flowing on surfaces from entering between the roofing and the masonry. A covering of metal, slates or tiles, cannot adhere to the stone, there always exists a separation between this covering and the construction of stone that rises above it. If this joint, necessarily imperfect, be marked by a projection that carries off the water, leaks occur under the roofs, causing the floors and vaults to decay. Today sheet zinc is inserted in the stone above the roofing, or more

frequently a joint is made tight by a fillet of plaster, that quickly disintegrates or breaks my the movement of the carpentrn subject to successive swelling and shrinking. The architects of the middle ages had the precious advantage over us of foreseeing everything during the construction of public and private edifices. Fastenings of sashes, rebates, setting ironwork, and numerous details that must occur in the entirety of a simple or complex structure, were calculated, foreseen and executed during the construction. But it was particularly in the system of removal of water, that those architects excelled us. They directed minute care to establishing permanent fillets suited to cover the joints of coverings with vertical surfaces, particularly after the end of the 12 th centurw, the time when they commenced to erect very vast edifices, on which even because of their great areas, the removal of water presented difficulties. In the Romanesque of the 11 th centurw however, it is already seen that the architects have preserved the junction of the shed roof of the side aisles with the wall of the central nave by means of projecting fillets (1). These follets extend around the projections of the buttress, horizontally at first (sketch A), then soon following the slope of the roof (sketch B), so as to leave everywhere between that fillet and the roofing only an equal space, sufficient to insert lead, slates or tiles. But difficulties present themselves, f for example, when shafts of buttresses or chimneys pierce the slopes of the roof (2). If the fillet A B prevents the water flowing down the surface D from entering between the covering and the side of the pier, it is necessary at C to find means of removing the water flowing down the covering, to the right and left of the thickness of that pier. There the fillet would be useless: it is necessary at C to have a gutter to discharge its water either on the roof, or into another gutter following the slope of the covering. This last means was thought of at first. Indeed the shafts of the flying buttresses of the choir of the cathedral of Langres, which dates frsm the middle of the 12 th century, presents to us gutters arranged as indicated iu Fig. 3. The gutter A receives the water from the upper slope of the coveriug; B at the side receives the water falling into the gutter A and on the ends of the tiles downwards. When the roofing is placed around this shaft, it assumes the

arrangement given in sketch T. Thus with no fillets of plaster or mortar, the upper gutter sends its water into the inclined gutters, that empty at the lower part of the pier into t the gutter X. At the cathedral of Langres, the inclined fillets are cut in a single great stone, made possible by the slight slope of the roof. This primitive method presents its i inconveniences. It is necessary to raise the tiles to join t the upper gutter A, thus leaving the interval between this raise and the continued slope of the roof; further, along the end D of the upper gutter rainwater can still pass between t this and the tiles. Later a greater inclination was given to the roofing, and inclined channels were omitted, which then could not be cut in a single course, they returned to fillets for covering the inclined parts, leaving the gutter only at the upper partfor receiving the water for the thickness of t the shafts of buttresses or chimneys.(4). Little gargoyles p placed at both sides of the thickness cast the water from this upper gutter on the slopes of the covering. Sketch A gives the elevation of this arrangement. A slight raising of the s slates, tiles or metal at C cast the water into the gutter, which because of the enclination of the roof, could easily be thrown on the roofing, passing under the inclined fillet E. Sketch B presents in perspective the gutter and fillet, the roof being assumed to be removed.

These details sufficiently emphasize the care devoted by a architects of the middle ages to those parts of the construction so much neglected today, but which have great importance, since they contribute to the preservation of edifices. It is due to this care that most of our monuments of the 12 th and 13 th centuries are yet standing today, in spite of prolonged neglect and frequently of ignoraut restorations. We dare not predict such long duration for our modern monuments, if they have to suffer the same negligence and the same lack of care; they will avoid great injury only if they are constantly maintained, their structure not hawing in itself the means of preservation, that we have seen adopted in antique architecture as in that of the middle ages.

FIXE. Oil Painting within Glass.

A painting done on a sheet of glass and protected from the

action of air by a covering of the same material. These were much used in the decoration of furniture [1] and even of interiors during the middle ages. A good number of examples are f found in the S. Chapelle of the palace at Paris and in the abbey church of S. Denis. They were also employed in small pieces to ornament the vestments of statues, fronts of altars, reredoses and tombs. They are even seen in pavements. (Arts. Application, Peinture).

Note 1.p.425. See Dictionnaire du Mobilier. Vol. 1.

FLECHE. Spire. Wooden Tower.

Habitually employed only to designate towers of carpentry covered by lead or slates, termina ing in an acute pyramid. Yet stone pyramids surmounting the twoers of churches are actual spires, and one can say; the spire of the old tower of Chartres, the spire of the catnedral of Strasburg, to designate the acute summits of those towers. In principle, every t tower belonging to the architecture of the middle ages is built to receive a spire of stone or wood; it was the required termination of religious towers. [1] Those conical spires or t those with square bases on the oldest monuments are at first of small height in relation to the towers, that they surmount (Art. Clocher); but they soon assume more importance, they affect the form of pyramids with octagonal bases; they end by becoming very acute, often have a height equal to that of the tower serving them as support; then they are pierced by dormers or openings, and finally form only a tracery of stone, li like the spires of the cathedral of Strasburg, Freiburg in t the Breisgau, Burgos in Spain. Very Shrewd constructors, as o one can recognize in passing through the Articles of the Ditionaire, the architects of the middle ages must have devoted very particular study to the construction of these great pyramids of stone, which rise to considerable heights, and thus are subject to numerous causes of destruction. If they displayed in these difficult works a profound knowledge of the laws of stability and of equilibrium, of materials and of the effect of atmospheric agents on their surfaces, they have frequently made proof of an acute observation very rare in the composition of those great pyramids, whose entire outline is detached against the sky. Further, they found no example in

antiquity of the first monuments of the middle ages [illegible]
[illegible]
epoch are of the middle of the 12 th century. One will indeed note that before that epoch (Art. Clocher), the terminations more or less acute of church towers with round or square bases are only roofs of stone or wood, that have only a minimum importance, or that rather resemble a head than an architectural conclusion. In spite of the effect of the sharpness, one feels that these coverings are not connected to the body of the structure, that they are merely superposed; while already the spire of the old tower of Notre Dame of Chartres forms with the base an entirely [illegible] qualities are still more apparent in the spires of Senlis, of Vernouillet, Laon, Reims, Limoges.[1] By transitions skilfully arranged by the architects they pass from the massive square base of the tower to the extreme point of the spire. Their attention was chiefly devoted to the outlines of these masses, for the least incorrection when the sky is the background shocks the least experienced eyes. Experience of each day (for we who think of everything but the outlines of our edifices, and who have adopted the rule of making application of [illegible] in the mass, insufficient if not illusory!) proves to us, that objects detached against the sky lose or acquire their relative importance, according to optical laws that seem very singular at first sight, and which still may be taken into account by calculation and reflection. These laws were perfectly understood by the architects that erected the immense spires of the middle ages, and one realizes their observation in even their most extraordinary works. Yet these laws could only be proved after experiences by the imitative method, or rather by the aid of a very developed delicacy of the senses, since the monuments of this kind arose suddenly about the middle of the 12 th century, already in the perfect state. The spire of the old tower of Notre Dame of Chartres, the largest that we possess in France, is perhaps the one combining in the highest degree those qualities in composition so difficult to acquire. The simplicity of its mass, [illegible] happy outline, make it an architectural work, that one cannot meditate on too much.

antiquity or the first monuments of the middle ages of this sort of compositions, that exclusively belong to that lay French art of the middle of the 12 th century. One will indeed note that before that epoch (Art. Clocher), the terminations more or less acute of church towers with round or square bases are only roofs of stone or wood, that have only a minimum importance, or that rather resemble a heap than an architectural composition. In spite of the effort of the architects, one feels that these coverings are not connected to the body of the structure, that they are merely superposed; while already the spire of the old tower of Notre Dame of Chartres forms w with its base an entirety, a homogeneous composition. These qualities are still more apparent in the spires of Senlis, V Vernouillet, Laon, Rheims, Etampes.[1] By transitions skilfully arranged by the architects they proceeded from the massive s square base of the tower to the extreme point of the spire. Their attention was chiefly devoted to the outlines of these masses, for the least imperfection when the sky is the back-ground shocks the least experienced eyes. Experience of each day (for us who think of everything but the outlines of our edifices, and who have adopted the rule of making architecture a sham ornamentation comprised in the mass, insignificant if not disagreeable) proves to us, that objects detached against the sky lose or acquire their relative importance, according to certain laws that seem very singular at first sight, and which still may be taken into account by calculation and reflection. These laws were perfectly understood by the architects that erected the immense spires of the middle ages, and one verifies their observation in even their most extraordinary works. Yet these laws could only be imposed after experiments by the tentative method, or rather by the aid of a very developed delicacy of the senses, since the monuments of this kind arose suddenly about the middle of the 12 th century, a already in the perfect state. The spire of the old tower of Notre Dame of Chartres, the largest that we possess in France, is perhaps the one combining in the highest degree those qualities in composition so difficult to acquire. The simplicity of its mass, the correct proportions of its various parts, its happy outline, make it an architectural work, that one cannot meditate on too much.

Note 1.p.426. See in the 7 th Entretien sur l'Architecture the facade of the church of Notre Dame of Paris with its projected spires left unfinished.

Note 1.p.427. The spires of Laon exist no longer, but their arrangement is known; those of the cathedral of Rheims are as easily divined, and we know those of S. Nicaise by good engravings.

It is necessary to establish certain general laws, that although very natural are often ignored when spires are to be erected, because we have a habit of composing entireties in elevation, as well as different parts of edifices, without t taking exact care of the effects, of perspective and development of plans.

Take (1) the square tower A B C D, on which we desire to e-erect a spire with octagonal base a b c d e f g h; we draw t the elevation E on one of the sides of the square of the tower; we give the height of the pyramid 3.25 times the side of the square, and we find a suitable ratio between the height of the spire and its base; but if we make the elevation on the plane G H parallel to a diameter g c of the octagon, we obtain the sketch F. Already the proportions that seemed good to us in the sketch E are modified in a disagreeable way in sketch F; the tower becomes too wide for the pyramid, and that e even has the height of no more than 3 times its apparent base, which is the diameter g c. Further, the shadows produce a bad effect on that termination by always giving to the tower lighted sides narrower than those of the pyramid; this will cause it to appear wide at its base. Now it is necessary to take i into account, that the elevation E can only appear at four points, while that the views F are infinite, then will be the infinite number of disagreeable views against four good ones. But the disappointment will be much greater when the edifice is erected, and perspective comes to deform again the elevation E. Assume that we are placed on the prolongation of the line I perpendicular to the plane G H at 147.6 ft. from the point C (see sketch A A) at K, the tower being 32.8 ft from A′ to e′; that this tower is 131.2 ft. high from the ground to t the base of the spire. When the spire is seen at that distance, it will give the sketch B B, for this because the perspective will appear to have in height only about 3 times the length of

the diameter l m, as demonstrated by the perspective projection m o. If at that distance we desired to obtain the appearance O P R, it would be necessary to double the height of the spire and bring its apex to n. If we intend to obtain in perspective a proportion similar to that of the elevation E, it would be necessary to triple the height of the spire to bring its apex to p; we should then obtain the appearance S P R. Assuming that we retire more than 492 ft. at K′, we even still see that spire t u. If on that spire we place a point at the middle of its height at v, and we are at K″ (see sketch M), in perspective the distance x v′ would appear greater than t the distance v′r. If at y we place an ornament whose projection does not exceed one tenth the total height of the pyramid, in perspective this ornament will be one sixth of the apparent height of the spire. These laws, that already seem complicated, are however but very elementary, when the composition of spires is concerned.

FLÈCHES DE PIERRE. Stone Spires.

Spires constructed of stone after the 12 th century, with rare exceptions, having octagonal bases and placed on square towers, it was first necessary to find a transition from the square prismatic to the octagonal pyramidal forms. Without apparent effort, the architect of the old tower of Chartres knew how to obtain these transitions (2). At the level K that terminates the tower, the projecting angles have been concealed by slightly projecting buttresses, that flank them. The s story L is also vertical and presents in plan an octagon, whose four sides parallel to the sides of the tower are larger than the other four. Four dormer pinnacles occupy the corners of the square base, and fill the recesses left by the octagonal plan. Above, the vertical story is ornamented by four great dormers on the faces and recedes more at the small sides than at the large ones, reaching a nearly regular octagon at the base of the pyramid. Yet that still presents four sides (those of the fronts) a little wider (by a quarter) than those of the augles.

Fig. 3 shows us at A the plan of one eighth of the spire of the old tower of Notre Dame of Chartres at the level L, and a also at B, the level of the base of the pyramid. At C one sees how the projections of the buttresses bear the jambs of the d

ornament-pinnacles, and at C how the angles of the tower are c
[illegible]
rect outline of this tower almost without projections. The p
pinnacles C are entirely detached from the pyramid above the
vertical story, so as to allow the light to pass between them
and the spire. It is the same for the gables placed on the f
front dormers, these gables are detached from the pyramid. Th
This is accomplished by considering that entrance [illegible] and lead
the eye from the vertical to the inclined lines; as it is ex-
tended to its apex, and [illegible] the principal form to be div-
ined.

The elevation [illegible] is taken between the level C and the top
of the gables, and sometimes the merit of this composition,
of [illegible] this to acquire
[illegible] experience, [illegible] was given to them by the very fre-
quent [illegible] of [illegible]
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[illegible] of this junction between the [illegible] square
[illegible] the pyramid, [illegible]
[illegible] of [illegible]. These spires [illegible] a [illegible]
[illegible], but [illegible] their taste and accurate eyes, could
[illegible] of [illegible] and, [illegible]
and [illegible]. [illegible] for [illegible] one [illegible], al-
[illegible] particular [illegible]
[illegible] only used [illegible]
[illegible] of all of the [illegible]. [illegible]
[illegible] so well that
this [illegible], whose [illegible] is 257.5 ft. above the ground,
[illegible] of experience and has suffered the [illegible]
[illegible] and [illegible]
[illegible] of its [illegible]. The [illegible] has 2.6 ft. [illegible]
its base and [illegible] ft. [illegible] like the entire [illegible]
[illegible] is built of [illegible] stone from [illegible], [illegible].
[illegible] of the [illegible] are 1.6 ft. [illegible]
[illegible] at the level [illegible], the tower [illegible] and is [illegible]-
ed [illegible], [illegible] from a sort of [illegible] the [illegible].
[illegible] the architects [illegible] connect the towers and
spires, as one can [illegible] the tower of the [illegible]
[illegible]

dormer-pinnacles, and at D how the angles of the tower are c concealed, so that seen diagonally the spire continues the r rigid outline of this tower almost without projections. The p pinnacles C are entirely detached from the pyramid above the vertical story, so as to allow the light to pass between them and the spire. It is the same for the gables placed on the f front dormers; these gables are detached from the pyramid. Th This is accompanied by appendages that surround it and lead the eye from the vertical to the inclined line; but it is engaged to its shaft, and permits its principal form to be divined.

Our elevation (4) is taken between the level L and the tops of the gables, and emphasizes the merit of this composition, at an epoch when architects had not yet been able to acquire the experience, that later was given to them by the very frequent construction of great stone spires on the towers of churches. This drawing causes us to feel the study and care that already at that epoch were brought to the very difficult arrangement of this junction between the structure with square b base and the pyramid; but it also unveils to us the uncertainties of experiments. Those artists had not yet found a sure m method, but sought it; their taste and accurate eyes, their f foresight of effect led them to the true one, but by divergent and indecisive means. Search for the true one by artists, also endowed with unusual refinement, gives particular charm to this composition, the more that these artists only used simple means, that they thought first of all of the stability, th that like constructors they neglected in part; so well that this enormous spire, whose apex is 367.5 ft. above the ground, counts seven centuries of existence and has suffered two terrible conflagrations, but is still standing and inspires no fear of its durability. The pyramid has 2.6 ft. thickness at its base and 1.0 ft. at its apex, like the entire cathedral it is built of hard stone from Berchere, admirable cut. The sides of the little pyramids at the angles are 1.6 ft. thick. However at the level K, the tower stops abruptly and is leveled up, and from a sort of platform springs the termination. later the architects thought to better connect the towers and spires, as one can recognize by examining the tower of the c cathedral of Senlis (Art. Clocher, Figs. 63, 64), and the sum-

summits of the towers of the cathedral of Paris, whose buttresses end in pinnacles and cross-flowers, already preparing for the recessions that must be made by spires on those towers,[1] as may also be verified at the cathedral of Laon, whose towers in their upper parts are accompanied by great open pinnacles, that flank the great octagonal story forming a very well adjusted base suitable to receive spires.

Note 1.p.432. In the 7 th Entretien sur l'architecture, see elevation and facade of Notre Dame of Paris with its two spires.

The spire of the old tower of Chartres is only ornamented by scales that represent wooden tiles, at the sides and middle of the eight sides of the hips.

When architecture became lighter during the first half of the 13 th century it was found that these apparently solid pyramids seemed heavy above the lower opened parts; more elegance and lightness was then given to the dormers, and in the sides were then pierced long slots, that showed these pyramids to be hollow. We see this system adopted by the constructors of the spire of Senlis. The architect of the old tower of Chartres had already sought to partly remove the dryness of the long straight lines of his spire by projecting parts, heads, breaking at certain distances the lines on the eight faces, and by chimera figures placed at the starting of the hips, in the tympanums and on the apexesof the pinnacles and gables. These details in full relief and casting strong shadows, attract the eyes and give scale to the mass. They went farther; already at the beginning of the 13 th century, the hips had projecting crockets, that were detached agaenst the sky and gave life and more lightness to the rigid lines of the pyramids. (Art. Clocher, Fig. 63). We ewen see that along the buttresses of the towers of the cathedral of Paris was sculptured in each course a projecting crocket producing a broken outline below the spire, as if better to connect their hips to the angles of these towers. The spire of the abbey church of S. Denis, built about 1215, still retained its hips without o ornaments; but there it was erected on a tower of the 12 th century, whose severe and vertical forms did not lend themselves to these projections. From this point of view, the spire of S. Denis was a masterpiece. The architect who built it, while adopting the composition of the 13 th century, knew how

with whom are to unite the forms accepted in his time with at-
[illegible]
to be placed. That spire gave a most happy outline; so justly it was the admiration of Parisians and foreigners. Its necessary destruction to avoid disaster was regarded as a public misfortune. It must indeed be recognized that the spires of o our churches of the middle ages excite in the multitude a very vivid and sincere admiration. The boldness of these tall pyramids, that seem to lose themselves in the sky, their happy outlines, always make a strong impression on the multitude, s sensitive also as to all that indicates an effort of intelligence, the idea expressed with energy. The French provinces [illegible] to indicate afar the communes and their cover. The example th thus given by them after the 12 th century was followed in Germany, and England during the 13 th, 14 th and 15 th centuries; but however the boldness and lightness of the spires of Freiburg in Breisgau, Salisbury in England, Vienna in Austria, it is far from these imitations of the monuments of this kind that yet remain among us, always remarkable by sobriety in o ornament, by refined study of outline, and by perfect understanding of construction.

Our readers will probably find it opportune to give them the basis of that celebrated spire of S. Denis, that we have been able to study with great care in all its details, since the sad task of demolishing it was imposed on us. The spire of S. Denis is a subject of study the more interesting, because the architect has shown in that work a profound knowledge of the effects of perspective, of lights and shadows; that resting on a slender tower with bad foundations and built of weak materials, he knew how to erect a spire of 108.? ft. with extreme lightness, so as not to crush its insufficient base; that concealing the meagerness of the vertical lines of Suger's tower a and the silent bonding of the inclined masonry, he skilfully transferred all the loads to the interior.

Note 1.p.424. Indeed, the threatening fall of the spire of S. Denis must be attributed to the increased weight given to it during the restoration by the substitution of stone from S. Nom for stone from Vergele, that originally composed the pyramid. It must also be stated, that the lower parts, the stories

with much art to unite the forms accepted in his time with st- still Romanesque construction in appearance on which it was t to be placed. That spire gave a most happy outline; so justly it was the admiration of Parisians and foreigners. Its necessary destruction to avoid disaster was regarded as a public misfortune. It must indeed be recognized that the spires of o our churches of the middle ages excite in the multitude a very vivid and sincere admiration. The boldness of these tall pyramids, that seem to lost themselves in the sky, their happy outlines, always make a strong impression on the multitude, s sensitive with us to all that indicates an effort of intelligence, the idea expressed with energy. The French provinces that first cooperated and executed these structures designed to indicate afar the communes and their power. The example th thus given by them after the 12 th century was followed in Germany, and England during the 13 th, 14 th and 15 th centuries; but whatever the boldness and lightness of the spires of Freiberg in Breisgau, Salisbury in England, Vienna in Austria, it is far from these inspirations of the monuments of this kind that yet remain among us, always remarkable by sobriety in o ornament, by refined study of outline, and by perfect understanding of construction.

Our readers will probably find it opportune to give them he here that celebrated spire of S. Denis, that we have been able to study with great care in all its details, since the sad task of demolishing it was imposed on us. The spire of S. Denis is a subject of study the more interesting, because the architect has shown in that work a profound knowledge of the effects of perspective, of lights and shadows; that resting on a slender tower with bad foundations and built of weak materials, he knew how to erect a spire of 126.3 ft. with extreme lightness, so as not to crush its insufficient base;[1] that recognizing the weakness of the external facing of Suger's tower a and the slight bonding of the internal masonry, he skilfully transferred all the loads to the interior.

Note 1.p.434. Indeed, the impending fall of the spire of S. Denis must be attributed to the increased weight given to it during the restoration by the substitution of stone from S. Non for stone from Vergele, that originally composed the pyramid. It must also be stated, that the lower parts, the stories

[illegible]

ut strengthening the solid parts, much changed by time.

Here (5) is one fourth of the plan of the lower part of the spire of S. Denis. At A the internal surfaces of the tower [illegible], the sides B of the octagon are supported by four squinches. On these have the architect had erected an internal colonnade composed of monoliths intended to transfer all the load to the interior by their incompressibility. Four dormers C opened in the four sides of the octagon; the four angles D were occupied by pinnacles. This colonnade formed an internal gallery E, which was reached by a stairs placed in one of the four angles and replaced one of the pinnacles; it permitted the oversight and maintenance of the structure of the spire. One will also note that the last course of the tower, which bears the pinnacles, does not strictly follow the square given by the earlier structure, but advances in form of a projecting angle to make the corner more solid and an appearance of greater resistance; that the columns supporting the pinnacles [illegible] still more [illegible], and that it seems [illegible] as the [illegible] by the manner in which they are placed; thus the architect evidently wished to accent strongly the angles, [illegible] with reason the bold and dry appearance of the [illegible].

Let us examine the elevation of this spire (6). If the [illegible] of these faces [illegible], if that [illegible] from right to left, the [illegible] of the lower [illegible] will be [illegible] by a half tint, while the angle F will be in full light, and by [illegible] the faces [illegible] of the pinnacles; the [illegible] of the half tint [illegible] face G, of the pinnacle on the right will accent the light [illegible] by the [illegible] face of the [illegible] and by its face [illegible] to the observer, then the [illegible] over the [illegible] face of each pyramid will the more accent the vivid light [illegible] by the [illegible] face D of the pinnacle on the left. Thus has been avoided that one part of the [illegible] should be entirely in the shade, while the other should be in the light, an arrangement producing a bad effect, making appear every pyramid or cone detached against

of the tower had not been consolidated, but on the contrary were weakened by external repairs made to the facings, without strengthening the solid parts, much changed by time.

Here (5) is onh fourth of the plan of the lower part of the spire of S. Denis. At A are the internal surfaces of the tower of the 12 th century. The sides B of the octagon are supported by four trumpets. On that base the architect had erected an internal colonnade composed of monoliths intended to transfer all the load to the interior by their incompressibility. Four dormers C opened in the four sides of the octagon; the four angles D were occupied by pinnacles. This colonnade formed an internal gallery E, which was reached by a stairs placed in one of the four angles and replacing one of the pinnacles; it permitted the oversight and maintenance of the structure of the spire. One will also note that the last course of the tower, which bears the pinnacles, does not exactly follow the square given by the earlier structure, but advances in form of a projecting angle to make the corner more acute and an appearance of greater resistance; that the columns supporting the pinnacles make this acuteness still more felt, and that it approaches the equilateral trinagle by the manner in which they are p placed; thus the architect evidentln wished to accent strongly the angles, fearing with reason the cold and dry appearance of the square plan.

Let us examine the elevation of this spire (6). If the sunlight falls obliquely on one of these faces (which is well understood to be the most frequent case), if that light strikes this face from right to left, the angle A of the lower cornice being askew as indicated by the plan, will be colored by a h half tint, while the angle B will be in full light, and by t the stronger reason the faces C D of the pinnacles; the contrast of the half tint on this skew face C, of the pinnacle on the right will accent the light caught by the oblique face of the pyramid and by its face parallel to the observer, just as the shade spread over the oblique face of that pyramid will the more accent the vivid light caught by the skew face D of the pinnacle on the left. Thus has been avoided that one part of the edifice should be entirely in the shade, while the other part should be in the light, an arrangement producing a bad effect, making appear every pyramid or cone detached against

the sky.

Let us cast our eyes of the section of the spire of S. Denis (7) made on an axis passing through the middle of the dormers. The elongated gables of these dormers are vertical, but do not so appear in elevation; in perspective they necessarily appear more or less inclined, unless the observer be exactly in the plane of these gables. One sees how the colonnade is only a rigid shoring to transfer the load of the spire to the internal surface of the tower. The perspective sketch C indicates one of the angle pinnacles removed and its connection along the face of the spire. Because of the inclination of these faces, the little columns engaged in the construction and taken in its courses up to the level D, are detached above that and monolithic. The imposts E, the two courses of the cornice G H are engaged in the courses of the spire; one will note that the second course that is not parallel to the first G, but that it tends to open slightly the angle of the pyramid to catch more light. That second course H, returning along the face of the spire on the projection I forms the projection H′ bearing the rear face of the triangular pyramid of the pinnacle of a gutter casting its water through two gargoyles. At K we have sketched the plan of this pyramid, whose a apex is placed so that the three faces have a similar inclination. The play of these more or less inclined lines was most happy, skilfully breaking the rigid edges of the spire without preventing the eye from following them, and had something both bold and refined that was charming.

The architects of the 12 th century had given to stone spires a considerable importance, compared with the towers that served them as bases. The spire of the old tower of the cathedral of Chartres is 196.7 ft. in height, while the tower is but 137.8 ft. The spire of the church of S. Denis was 126.3 ft. high and the tower is 114.8 ft. The proportions given by the facade of the cathedral of Paris must cause the admission, that the spires would double the height of the towers. Gradually architects gave less importance to spires. (Art. Clocher, Figs. 63, 75). Those of the cathedral of Rheims would have had scarcely half the height of the towers, like those of the church of S. Nicaise of the same city. The spires of the cathedral of strasburg is short and slender compared with the dim-

dimensions of the tower; it was only completed about the middle of the 15 th century.

As a structure, that spire is the strangest conception that can be imagined. The effect produced however, is far from responding to the efforts of the intelligence required to draw a and erect it. Besides, there is every reason to believe, that it was not entirely executed as it was conceived, and it certainly lacks in its outlines very important appendages, that have never been finished. In the museum of the work of Notre Dame of Strasburg, there exists a curious drawing on vellum f from the end of the 14 th century, which gives us the horizontal projections of the project of the spire. This drawing was very skilfully made and indicates differences in detail between the project and the execution; however one can regard the spire of Strasburg as a conception of the 15 th century.

The cathedral has claimed to render accessible to all the apex of this spire, not by ladders or by a little internal st stairs, but by means of eight easy stairs combined with eight hips of the pyramid, and that lead to the last central stairs ascending to the very small upper platform, the summit of a lantery crowned by an extreme point. These eight stairs, the sides of the spire and the central stairs are merely a tracery structure, a sort of stone scaffolding combined with very extraordinary science in drawing, but very moderately executed, poor in style and finished well or badly with haste and parsimony.

We give (8) one eighth of a drawing of the spire of Strasburg after the sketch of the 14 th century. By means of four o open stairs winding in four great pinnacles placed at four angles of the tower, according to this drawing one should reach the gallery A at the base of the spire. Thence passing across the opening one enters the stairs at B forming the eight ridges; ascending two steps, he should find a landing, then the first step of the winders at C. The slope of the stairs being naturally very steep, to reach the first landing D of t the lantern are required a very considerable number of steps. The architect then had the ingenious idea of placing 6 hexagons intersectiug each other, thus presenting a series of entirely open turrets, in which the steps wind around newels in one direction or the other, allowing rapid ascent to a great

height within the very short space. Reaching the landing D ((always according to the original project), one took the great screw stairs E, probably double, that must rise to a second platform, from which by a stairs of smaller diameter he ascended to the upper lantern. The space G remained open and through lunettes opened in the vaults of the tower, allowed the pavement of the church to be seen. This was a conception of p prodigious boldness. In execution this project was modified a little (see sketch X). The hexagonal turrets were built; but reaching finally the last of each angle at H, one passed behind the half turret I to ascend to K, and thus at each bay. A person ascending by the angle turrets L thus reaches the platform of the lantern at K. There is found a central screw stairs as in the project, except that the enclosure of this stairs is octagonal outside instead of being square. As for the sides M of the pyramid, they are built of horizontal courses, like the spires presented at the beginning of this Article, but a are composed of great open tracery between the angles as indicated by the sketch P, and separated by lintels Q that serve as struts between these heavily loaded ribs, since they carry the verticals of the turrets. According to the project the a-angles B of the square lantern were eamh supported on the two ribs O, as if by two stone struts. The four great pinnacles receiving the four stairs reaching the platform A, and the h hexagonal turrets of the angle stairs of the spire, had been combined to be terminated by tracery pyramids, which would h have produced a surprising outline with great effect. Resources were probably wanting, and all these terminations became square, that at a distance produced a series of colossal steps with a deplorable effect.

It is understood that the spire of the cathedral of Strasburg is a masterpiece, and we do not pretend to deny it; but this very general admiration is particularly caused by the excessive height of the edifice. For us architects, whose admiration does not increase with the height of monuments, we m must regard the spire of Strasburg as one of the most ingenious conceptions of Gothic art in its decline, but as a conception poorly executed. It is certainly not what the author of the design on vellum imagined, of which we have just given a fragment, he doubtless desired to obtain a rampant outline de-

delicately opened by means of a series of little pyramids intersected by those hexagons so skilfully joined together, and not a series of steps, that arrest the eye in the most disagreeable manner. Placing a square lantern on the octagonal pyramid of the spire, he claimed to accent the termination by a form contrasting with the obtuse angles of the base. He certainly should have crowned that lantern by a final octagonal and very acute pyramid, and not by that swelled little lantern that terminates the actual spire. But if about the middle of the 15 th century Gothic architects had become excellent geometers, shrewd jointers of masonrw, they had lost that exquisite feeling for form found in their predecessors. Their ingenious combinations, their pretense of excessive lightness, led them to heaviness by the multiplicity of the details and the complication of forms, whose sense can no longer be discerned. Particularly in the outlines appear these defects; s simple and comprehensible forms being the only ones which produce effect, when one comes to detach an edifice from the sky. However, the examination of the working drawings of Strasburg allows something good to be divined, superior to what we see, and for the honor of the successors of Erwin of Steinbach, it is necessary to believe that money was wanting to them, as to all architects that have been charged with completing or continuing cathedrals durius the 14 th and 15 th centuries.

According to the project, the 6 hexagons forming the winding stairs, built of stone verticals connected by tracery and lintels, should terminate in small tracery pyramids, each intersected by two sides of the upper hexagon; so that only four faces of the six of those pyramids alone were visible as abutting the successive newels receiving the projecting angles of these hexagons. A perspective sketch (9) will render this original arraugement. Thus the superposed summits of the hexagonal turrets now finished square like a series of steps, gave by means of these pyramids a rampant line broken by pinnacles and statues. Further, the open construction of the turrets entirely composed of verticals, and that are only joined together by the aid or iron, could be perfectly abutted by these pyramids that act as struts. That was a logical construction, c conformed to the requirements of the architecture of that epoch, which did not accept horizontal rests, particularly at

the tops of edifices.

By examination of the plan (Fig. 8) it does not appear that the architect author of the project desired to establish betw-een the angles tracery composed of slabs of tracery in the f form of faces of the pyramid; he needed the more resistant con-struction to support the great upper lantern, the construction indicated by the solid piers S. Yet one cannot admit that these piers were inclined like the faces of the pyramid; which would have produced a very bad effect. We should rather see in these piers the springings of arches of very low rise, but in a ver-tical plane and receiving tracery gables, that by the effect of perspective surmount the tracery terminations T. Besides, in the existing spire the architect established at the level of the third bay at N horizontal passages connecting the eig-ht stairs; these passages are borne on lintels and form the second termination, that intersects the spire in a bad manner. We do not admit that these passages were foreseen by the aut-hor of the project, but that their horizontal form was interr-upted by the outlines of the gables passing before them; an arrangement explained by our Fig. 9. The foot of the pyramid being strongly maintained by piers S, it could be constructed above the arches V by means of stone framework between the h hips, according to the definite execution. Perhaps one may t think that we lend to the architect author of the project of the spire of Strasburg, ideas that he never had, but one only lends to the rich. The art of architecture, particularly in epochs when it was necessary to employ enormous sums to execu-te ideas, can be judged with difficulty by what time has left to us. Most frequently the happiest conceptions, the best st-udied and rendered in an incomplete manner for lack of resour-ces, or have been mutilated by time and unfortunate restorat-ions. It is the misfortune of this art, not to be able to tr-ansmit its conceptions in their purity. Having presented the existing spire of the cathedral of Strasburg as a delicate work of mediocre execution, we shall not be blamed for having at t the same time sought to emphasize the qualities of the primit-ive conception, for having restored the merit to the artist, since we have shown ourselves severe toward a work evidently incomplete. Many other bad constructions have destroyed the u unity of conception of the western facade of Notre Dame of St

Strasburg; the central belfry between the two towers is a monstrous addition, that absolutely changes the proportions of this facade, a useless addition that must greatly torment the Steinbachs in their tomb, if indeed architects in the other world know of the changes that their works suffer, which would for us without exception be a continued torment.

If the architects of the 15 th century had possessed the resources at the disposal of those of the beginning of the 13 th century for the construction of great cathedrals, they would have left us stone spires, marvellous in their combinations, for the architecture of that time lent itself more than any o other to those sports in stonecutting. Yet it is doubtful that those monuments could produce more effect than our stone spires of the 12 th and 13 th centuries, sober in details but of perfect elegance in outlines, and permanently more solid and durable. The royal domain is the true native land of spires; there must one study the principles that directed our architects of the lay school at its origin. Normandy erected during the 13 th century a great number of spires that still exist, thanks to the goodness of the materials of that province; but these conceptions are far from equaling those of Ile-de-France. The spires of the abbey.aux.hommes of Caen, of the cathedrals of Coutances and of Bayeux, do not presnt us with a perfect harmony of the details with the entirety; their pinnacles are mean, confused, covered by members too small for the places t that they occupy; the outlines are soft and undecided, never having that virile energy that charms us in the contours of t the spirer of Chartres, S. Denis, Senlis, Vernouillet and Etampes.

FLECHES DE CHARPENTERIE. Wooden Spires.

It would be difficult for us to state at what epoch date the first spires constructed of wood. They existed in the 12 th c century, since mention was then made of the burning of wooden towers; but we have very vague statements of their form. Those spires then probably consisted of great pyramids placed on s square towers, covered by slates or lead and pierced by dormers more or less monumental. Further, it is necessary to properly define what should be understood by a wooden spire. In t the north of France many stone towers were, and are covered by hip roofs of wood, that properly speaking are only very ac-

acute roofs. The wooden spire is a separate and complete work, that possesses its substructure, its stories and its roof; it is true that it can be placed on a tower of masonry, as were the spires of the cathedral of Amiens before the 16 th century, that of Beauvais before the fall of the transept, that of Notre Dame of Rouen before the fire, and still is that of the cathedral of Evreux; yet it is always characterized by a particular arrangement belonging to it; it is entirely a structure of wood placed on an edifice of stone, that serves it as a s support, like the modern domes of S. Peter, Val-de-Grace, Invalides, distinch monuments, independent of the mass of the structures that bear them. These works of carpentry are the o ouly ones that merit the name of spires. One might believe t that the spires of the middle ages of each epoch must have b been quite rare, because of fires, neglect of maintenance and time; still must of the great number were erected after the end of the 12 th century, that we still possess some, and that precious information remains to us concerning many.

All leads to the belief that the plan of the great churches and of the cathedrals in particular from the beginning of the 13 th century were conceived with the idea of erecting a square tower on the four piers of the crossing. Several of our g great cathedrals have had or still possess those square towers. Amiens, Rheims, Beauvais have had their masonry tower over the middle of the transverse aisle, Rouen, Laon, Bayeux, Evreux, Coutances, have retained entirely or in part. But either many were lacking, or architects may have recoiled from the danger of loading too heavily the isolated piers of the transepts, nearly everywhere those towers were not completed or were crowned by wooden spires covered by lead, which in spite of their considerable weight, were far from loading as much the lower parts, as a stone structure would have done. Y Yet some cathedrals do not appear to have ever received masonry towers over the crossing. Paris, Chartres, Soissons, present no traces, no more than Senlis, Meaux and Bourges, because these last monuments were conceived without transepts. Without masonry towers over crossings of churches, men had the idea of erectiug great towers of carpentry combined with the roofs. Notre Dame of Paris possessed a wooden spire covered with lead, which dated from the beginning of the 13 th century. That spire

was demolished about 50 years ago, and certainly was the oldest of all those existing at that epoch; its body still remained entire at the intersection of the roofs, even at the last. Now of spires of carpentry, the most important part that demands most study and care is the base. So we have accurately drawn this remnant of the old central tower of Notre Dame of Paris, before removing it to substitute for it the new carpentry, wh which further is established according to the primitive system.

See in what this consists (10); A B, A B, being the 4 piers of the transepts and C D the ridges of the two roofs intersecting at a right angle; the spire above the roofs is established on an octagonal plan, its angles being placed on the ridges of the two roofs and in the four valleys. The octagonal base is supported by two diagonal trusses A A, B B, intersecting w with a single kingpost G, which is the vertical axis of the spire; further, the four angles I are maintained in the vertical planes A A, B B, by means of great braces I A, I B. These struts meet at K and thus form the principals of the 4 inclined trusses K A B, whose apexes K support the 4 angles L of the octagon. By these means the 8 angles of the octagon are directly supported by the trusses, and the swaying of the entire system is stopped by the intersecting struts I A, I B.

It is necessary to know that this very elevated carpentry a always fails by the twisting moment produced near the base of the ridge. In fact the timbers being unable to change, they cannot shrink; the effect of wend and the weight ends by stressing the weaker point more than others; the entire effect i is then produced at that point, and the movement of rotation occurs that breaks the joints, curves the timbers, leads to the ruin of the carpentry. The system adopted for the base of the spire of Notre Dame has the result of causing, that not only is torsion of the base made impossible by the intersection of the braces, but also that each angle of the octagon tr transfers its load to two or even three piers. The angles L rest on the two piers A B, and the points I on three piers A B B or B A A . This system thus has again the advantage, that when the pressure of the wind acts on one side, always at least two piers of the transepts receive the additional load p produced by that pressure.

Now that this system is known, let us examine the application

of it at Notre Dame of Paris. The piers of the transepts of the cathedral do not form a square, but the quite irregular q quadrilateral, which adds to the difficulty of establishing carpentry resting on only four points of supporting a pyramid with octagonal base. Fig. 11 gives the horizontal projection of the base of that spire, assuming the section made above the ridges of the roofs; the timbers A B are the great struts that bear both the posts C at their intesections and the posts D, which at the same time they abut. These struts A B are kept r rigid by strong double ties E G, fixed by wooden keys; so that the two triangles C E G are inclined trusses for which the po posts C H serve as kingposts. Two great diagonal trusses I K directly support four angles of the octagon.

We give (12) one of these great diagonal trusses composed of a strengthened tiebeam resting on the low masonry wall and relieved by strong braces, whose foot A rests on the heads of t the piers below that masonry wall; of two principals C D and of bent sub-principals E F, framed into a central kingpost as the axis of the spire. The great braces A are also doubled. The principal posts forming the octagon of the spire are tripled from H to I, i.e., are composed of a middle and two outer timbers. The posts of the buttresses K L are single and a are halved into the principals C D. One will note that these posts are strongly inclined toward the principal axis. The b buttress posts K L were originally abutted by great struts M L, that were over the valleys and presented a projecting s side, formerly decorated by pendant double ties O P covered by lead and accompanied by perforated timbers, whose remains R have been found. The post S, that was combined with that de decoration and remained in place, formed the head of this system of shores, visible above the four valleys. A capital V c carved on the middle kingpost gave the exact date of this spire (beginning of the 13 th century).[1] At a very early epoch these visible and decorated shores placed in the valleys, so necessary to the stability of the spire, had been removed, p (probably because they had been altered by time, not having b been cared for); this must have contributed to weaken the principals, which then must transfer the entire load to the posts K L.

Note 1.p.449. This capitol was preserved at the removal of the spire.

Fig. 13 gives the framing at the level T, and Fig. 14 is that at the level X.

Fig. 15 permits one to see the arrangement of the great stuts A B of the plan, Fig. 11. It is seen how these struts support at their intersections G the posts C H, how they are framed at the heads into the posts D K at D, how the horixontal double ties E F hold both these struts and the lower end of the post C H, also how the triangle G E F presents the system of an inclined truss resisting the load of the post C H. If we resume Fig. 11, we note that not only the posts forming t the eight angles of the spire are inclined toward the central axis so as to form the pyramid and not a prism, but that these posts give a double system of supports. We do not speak of the doubled timbers that triple some of these posts, because these are only furrings suited to give more stiffness to the posts and support in the direction of their thickness, and are especially intended to receive lateral framing, so as not to weaken the principal posts by mortises. This system of twin posts separated by a space is a very powerful means of resisting the pressure of the wind. It is seen that these posts are well connected together by doubled horizontal timbers at certain distances, and offer extremely rigid points of support. Indeed l let (16) two posts A B, C D, be fixed between the doubled timbers E F G; for the post C D to bend according to the line C I D, it is necessary for the post A B to contract, which is not possible; for it to curve according to the line C K D, it is necessahy for the post A B to lengthen, which is also impossible. The quadrilateral A B C D connected by the timbers E F G is thus not capableof deformation. Thus, faithful to th- this elementary principle, the Gothic architects have never failed to apply it in the construction of their carpentry spires, and as always have made of it an ornamental motive.

The base of the spire of Notre Dame of Paris however presents weak points, although it was combined in an ingenious manner, and that the system of carpentry was very good; thus the great diagonal trusses (Fig. 12) were not sufficiently ironed at the feet, the double struts A G did not perfectly abut the external posts of the pyramid, the principals were weak; and the tiebeams were raised and without strength. The trusses of the roof (those resting on the great struts, arranged as X-bra-

Towers, Fig. 15) did not find an [illegible] of [illegible] at the junction of these great arches, because of their great length and could bend, which occurred at the same [illegible] the vault. Consequently the entire spire must be inclined and strain its joints. Generally the lower timbers were not sufficiently large; also for carpentry subject to [illegible], the wooden keys are evidently insufficient, especially when in time these timbers dry and no longer fill the holes in which they are inserted. Hence while reproducing the principle on which this carpentry has been framed, are must in the reconstruction of the spire of Notre Dame of Paris improve the entire system, and introduce the improvements [illegible] by modern industry. One forms with difficulty the idea before having tested it, of the force of the wind on carpentry placed at a great height on [illegible], [illegible] the air above the [illegible] of the city. The [illegible] of air [illegible] is such, that it [illegible] the [illegible] of the [illegible] [illegible] falls [illegible] [illegible]; [illegible] necessary to have [illegible] [illegible] in all parts of the [illegible], so that [illegible] in [illegible] form [illegible] the [illegible] of [illegible]. The [illegible] [illegible] [illegible] is [illegible] the arm of a lever, [illegible] [illegible] by [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible], [illegible] that in our climate the [illegible] [illegible] [illegible] the [illegible] of the [illegible], [illegible] the [illegible] or [illegible]. This [illegible] [illegible] [illegible] the [illegible] of the [illegible] must be the [illegible] of [illegible] for the [illegible]. [illegible] the system [illegible] by the [illegible] of the 12 th century, it [illegible] [illegible] 1, to [illegible] the base of the [illegible] four feet [illegible] [illegible] able to resist all vibration; 2, to connect [illegible] with the [illegible] itself in such a [illegible] manner, that all [illegible] [illegible] in one [illegible] is [illegible] to at least two [illegible] of [illegible] and even to [illegible]; 3, to [illegible] [illegible] the [illegible] [illegible] of the [illegible], [illegible] in the old system, [illegible] [illegible] [illegible] [illegible] being [illegible] the [illegible]; 4, to [illegible] from [illegible] to bottom the entire system of framing the [illegible] of the spire, so as to avoid not only [illegible] [illegible], but even the [illegible]; 5, to avoid joints

X-braces, Fig. 15) did not find an immovable point of support at the junction of these great struts, because of their great length and could bend, which occurred at the side opposite t the wind. consequently the entire spire must be inclined and strain its joints. Generally the lower timbers were not sufficiently large; also for carpentry subject to hurricanes, the wooden keys are evidently insufficient, especially when in time these timbers dry and no longer fill the gains in which they are inserted. Hench while respecting the principle on which this carpentry had been framed, one must in the reconstruction of the spire of Notre Dame of Paris improve the entire system, and introduce the improvements furnished by modern i industry. One forms with difficulty the idea before having tested it, of the force of the wind on carpentry placed at a great height on four feet only, that rises in the air above the other edifices of the city.[1] The pressure of air currents is such, that at certain moments the entire weight of the carpentry falls at the side opposite the direction of the wind; thus it is necessary to have complete stability in all parts of the system, so that this pressure cannot in any case throw the entire weight on one point of support. One must think that this carpentry is like one arm of a lever, that if not maintained by an immovable support will not fail to crush or dislocate one of the four piers that serve it as a support, the more that in our climate the great winds always come from the same point of the rorizon, from the northwest or southwest. This pressure being repeated on one side of the carpentry must be the subject of thought for the constructor. Starting from the system accepted by the architect of the 13 th century, it has then been sought:- 1, to form at the base of the new spire four feet absolutely rigid and able to resist all vibration; 2, to connect these four feet with the spire itself in such a strong manner, that all pressure acting in one sense is transferred to at least two piints of support and even to three; 3, to support equally the eight angles of the pyramid, while in the old system, four of those angles were supported better than the other four; 4, to double from top to bottom the entire system of framing the octagon of the spire, so as to avoid not only rigid hips, but even the faces; 5, to avoid joints by mortises and tenons, that are strained by the effect of vi-

vibrations, and to replace them by by the system of doubled timbers that do not weaken the timbers, connect them and give them a considerable resistance; 6, to only employ iron bolts, so as to leave the carpentry its elasticity; 7, to reduce the weight upwards by employing smaller timbers, but at the same time increasing the force of resistance by the combination of the carpentry.[1]

Note 1.p.452. The apex of the spire of Notre Dame of Paris is 315 ft. above the pavement of the church.

Note 1.p.453. On Feb. 26, 1860, a gust of wind that overthrew in Paris a great number of chimneys, carried off roofs and threw down some wooden triangulation stations, only caused the spire of Notre Dame to vibrate about 0.08 inch at its top, although then that spire was not entirely completed, and it was only covered by lead on its upper part, which must make the v vibration more sensible.

We have just stated:- the four transept piers on which rests the spire of Notre Dame of Paris are not placed at the angles of a square, but of a quadrilateral with unequal sides, which a added to the difficulty. To not complicate the Figs., we do not take into account here small irregularities, and we assume the parallelogram with larger sides of 48.39 ft., and smaller ones of 41.83 ft. Four diagonals of the octagon of the spire must necessarily rest on the two diagonals of the quadrilateral, this octagon is irregular, having four sides larger than the other four. Fig. 17 gives at A the plan of the bottom framing at the level of the great diagonal tiebeams, which are each composed of three superposed timbers having 9.8 ins width at the kingpost. This drawing shows that in the horizontal projection the four feet on which rests the base of the system. These four feet are formed of a combination of braces under the tiebeams and of inclined trusses B C passing in the p planes of the truncated pyramid, whose base is the quadrilateral given by the piers, and the upper section by the plan of the framing at the level of the tiebeams. Each angle of the body of the spire is composed of three posts, that do not rise vertically, but form a very high pyramid with octagonal b base; i.e., in rising these posts approach the kingpost.

Let us now examine one of the great diagonal trusses D E. (18). One sees at A the three superposed tiebeams, stiffened

and maintained at first by the two braces B halved and forming an X, then by two strong doubled braces C D, that receive the inclined braces indicated at B C in the preceding Figure. The heads of these two doubled braces grip at E the feet of the t three posts of the angle of the spire. The central kingpost is at F. Great braces G H follow the valley given by the intersection of the roofs; consequently all above these braces is v visible. The braces I K are doubled and form a ridge in the valley, throwing the water to right and left by means of rafters, and allowing to be seen opened steps decorated by arches and surmounted by statues on the four posts. Other braces M N connect together the entire system and join the central kingpost at O. Further this half truss is maintained by double h horizontal timbers that join together its different parts, p prevent all dislocation and make this carpentry a stiff plane, immovable and not to be deformed. The sketch A A of Fig. 17 g gives us the plan of the framework at the level P of Fig. 18; the sketch A A A is that of the framework at the level R, and the sketch A' is that of the framework at the base of the pyramid, that terminates the spire above the second open story. In the sketch A A of Fig. 17 is seen the arrangement of the rafters dividing the valley in two parts, permitting the passage of the four posts bearing the statues.

This system of vertical posts traversing the diagonal half trusses and forming a decoration above the valleys (a system that had been adopted by the constructors of the 13 th century) presents several adwantages; it makes these half trusses actual half timber work aud perfectly rigid; it forms a series of kingposts that strengthens the principals, maintaining them in their vertical planes without loading the tiebeam in anyway. It also presents an ingenious decoration by explaining externally, how the spire rests on the four piers of the crossing, and also because it forms a transition between the masonry of the church and the body of the spire, which it serves as a b base, the flying buttress, so to speak. One sees at V (Fig. 18) how are decorated these steps of the great principals above the valleys. It is easy to understand how are supported the four angles of the octagon, that rest on the diagonals; as for the four angles falling on the ridges of the roofs, let us see the system adopted. At B B (Fig. 17) are erected strong

trusses resting on the low walls and the four piers of the transepts; on the middle of the tiebeams of these trusses rest the horizontal timbers L M strongly relieved at C by the inclined timbers B C. Above this point 6 rest the triple posts f forming the other four angles of the octagon; the point M supports only the feet of the braces intended to maintain the p posts in their plane.

Fig. 19 presents one of these trusses B B, which serves at the same time as a roof truss. At A is seen the end of a horizontal timber drawn as L M in Fig. 17; at A′ that end is seen in section on a b. There is no need of explanation to feel t that this end A cannot deflect. At B′ we have given the detail of the connections at B, and at C″ are those of the X-braces with the kingpost.

Now let us examine this system of the base in perspective. (20). At A are seen the great triple tiebeams of the diagonal trusses; at B the arrangement of the timbers forming inclined trusses, stiffening the base of the spire and bearing at C the four angles of the octagon; at D appear the fragments of the tiebeam of the truss given in the preceding Figure, with the half timber work maintaining the angle posts resting on C, E being the kingpost of that truss. Braces F relieve the posts C and transfer their loads to the four principal resisting points A; these braces have the advantage of preventing the entire system from swaying. Above X-braces G are doubled, and also transfer the loads to the posts C of the diagonal points of support. The timbers I and F replace with advantage the great inclined timbers of the old carpentry, that we have described above. This system is further tripled in the existing carpentry, and we see it reproduced in K L and K M; so that if an unusual pressure is produced at O, this pressure does not load the point C, but rather the feet I, and even gradually three of the piers of the transept by the arrangement of X-braces and the struts F. One will note that these X-braces are doubled, i.e., are connected with two of the three posts, that form each angle at the base of the spire. There ir then no possibility of vibrationin that carpentry; none of its parts can receive an extra load without transmitting it to two or even three of the four points of support on which it rests. Even assuming that one of the four piers of the transepts were

removed, the carpentry would remain standing and would transfer all its lads to the three remaining piers.

The system according to which was established the base of the spire of Notre Dame of Paris being well known, let us examine this spire above the ridges of the roofs, i.e., above t the level at which it begins to detach itself against the sky (21). A perspective view presents at the right side the spire without its ornamentation, and at the left side the decorated spire. At A is one of the four trusses corresponding to the diagonal trusses; one will observe the inclination of the posts forming the augles of this spire below the upper pyramid, that only commences at the level B. That inclination, including the successive recessions, is less than 2.62 ft. in a height of 49.2 ft.; yet by the effect of perspective one scarcely perceives the diminution of the body of the spire other than that produced by the recessions C. Further, if the eight angles of the octagon were made vertical, the body of the spire would appear larger under the upper pyramid than its base. The illusion of the eye here accords with the condition of stability; indeed these eight angles, that tend to approach the kingpost as they rise, lead the eye to the pronounced pyramidal form of the termination, and at the same time transform the series of shores that maintains the central axis vertically. By the singular effect of the contrast of the vertical and inclined lines detached against the sky at a great height, if the pinnacles D crowning the augle posts were vertical, they would seem to spread outwards, when seen perpendicular to the line of sight. It is necessary, that in a monument so elevated and whose general form is so slender, all liner should incline toward the axis, if one desires that nothing in the entirety should oppose the outlines. We give at E the termination of the spire, whose crown F is 147.6 ft. above the ridge of the roof.

We have stated that the carpentry in rising is composed of timbers gradually lighter, but more strongly connected. Examining the framework sketched at G, one recognizes how much resistance it presents; this system is adopted for the four frames indicated at G and in elevation at A. This framework is composed of doubled timbers halved together as shown by detail I, intersecting at right angles and binding the kingpost,

four angle posts, and is stiffened by braces K so as to form a square; immediately below the second framework set diagonally to that and combined in the same manner produces in horizontal projection a star with eight points, that gives the secion of the pyramid. Not only does this pyramid present great resistance, but it has the advantage of giving to the pyramid shadows always accented, that correct it to the eye and give it the more elegant appearance. When the pyramids and spires are also acute and are erected on a section simply octagonal, if the sun strikes one side, a part of the pyramid is entirein the light and the other is in the shade; at a distance the light side is confused with the sky, and the dark side gives an inclined line, that is not balanced, so that the pyramid seems out of plumb. The great pinnacles with their crockets that always furnish dark and brilliant points entirely around the pyramid, at the light side as at the side opposed to the light, also contribute to prevent these illusions of the eye, which are produced by masses of shadows without light spots, opposed to masses of light without shadows. We cannot repeat too frequently; when the edifice or a part of the edifice is entirely detached against the sky, nothing is indifferent in the ma s or in the details, the least carelessness in the adoption of ornament, in the trace of the outline, entirely deranges the harmony of the masses. It is necessary for all to be clear and easily understood, that the mouldings and ornaments be at the scale, that they do not oppose the outlines, and still that they are visible and appreciable.

The spire of Notre Dame of Paris is entirely built of oak from Champagne; all woodwork is covered by sheet lead, and t the ornaments are in hammered lead.[1]

Note 1.p.481. The carpentry of this spire was executed by M. Bellu, the leadwork by M M. Durand Bros. & Monduit. The whole, including ironwork, weighs about 551 tons. Each pier of the transepts can bear this weight without crushing. The twelve statues of the apostles and the four figures of the symbols of the evangelists, that decorate the four ridges in the valleys are in hammered copper, executed after models furnished by M. Geoffrey-Dechaume.

Then as now the opportunity for erecting carpentry spires of such importance did not often present itself. Lead was for-

formerly dearer than today, although its price may still be very high; on little bhurches of market towns, villages or po- poor abbeys, men only thought of covering with slates the car- pentry spires. In that case it was necessary to adopt simple forms, to avoid large openings, and to protect well the timb- er from rain and the action of the sun.

We have already stated many times, that the architecture of the middle ages lends itself to the execution of works most modestly conceived as to that of the richest works; that alone will prove it a complete art. If architecture cam apply itself only to sumptuous edifices, and if finds itself deprived of i its resources when it is necessary to keep to what is strict- ly necessary, it is no longer an art, but a dress without re- ason, a matter of fashion or vanity.

We give (22) an example of those spores entirely covered by slates, erected like that of Notre Dame of Paris over the in- tersection of the roofs; this is the spire of the church of O Orbais, formerly dependent on an abbey. Excepting the ends of the kingposts, that have very simple lead caps, the entire c carpentry is covered by slates. At A is seen the half of one of the half timber shaft of the spire; C D is the principal of the roof. As always,that shaft is diminished, being 16.0 ft. at base and 15.3 ft. at top at the level of the base of the pyramid. That is octagonal and its angles are set on the mid- dle of the frames as shown by the sketch B. The corner timbers E are relieved by struts G framed into the corner posts H, and on the angles F are placed four little pinnacles, visible on the perspective sketch. The body of the spire, the pyramid, the pinnacles and the dormers are covered by small thick sla- tes nailed on oak battens. There are lead sheets in the vall- eys. That edifice, so simple, has such a charming effect beca- use of these projections, and particularly because of the hap- py proportions of the whole; it dates from the 14 th century. The bell cage is independent of the carpentry of the spire, a and like that only rests on the four piers of the transepts.

One still sees over the crowning of the old abbey church of Eu the base of the spire in carpentry of the 15 th century, whose original arrangement merits being mentioned. This was a pyramid passing from the square to the octagonal plan in the height of the roof, so that the inclination of the sides con-

continued without break from the ridges of the roofs to the a apex of the spire. This system offers great stability.

Let (23) A B be two of the four points of support of the transepts, inclined trusses B C forming the faces of the pyramid with square base. The projection of the trusses of the r roofsis given by the triangle A B D; then the triangles A D C, B D C, are seen above the slope of the roofs; the brace A E p passes in the plane of the two principals A G, A P. The king-posts I C pass in the plane of the octagonal pyramid. At the level of the ridges of the roofs is placed a frame on an octagonal plan G F K, etc., tenoned into the inclined principals A P, A G, B C, etc. The elevation X of half the spire from B to I shows the projection of the roof in B′D′, the great inclined truss in B′C″, inclined in the plane B′O. The braces A E of the horizontal plan are seen in B′E′, and the first octagonal base at L, on which rest the actual hips of the spire. H Here the angles of the octagon do not correspond to the ridges of the four roofs and the four valleys, but indeed the middles of the sides of this octagon. At N are traced one of those diagonal braces A E, and the section E P is made at the middle of one of the four sides of the pyramid next the valleys; dormers R are opened on these four sides . A gallery S breaks the uniform appearance of the spire and serves for the watchmen. The framework at the base of that tower is traced at M. The framework Q is traced at Q′, the fourth and fifth frames being combined in the same fashion. At V′ the prespective sketch indicates the junction of the inclined timbers of the spire with the first octagonal frame La This spire has been removed to the level Q, but a painting of the 17 th century deposited in the church of Eu, presenting a very well executed view of the buildings of the abbey, gives us the rest of the spire and its system of decoration, that did not lack elegance.

Fig. 24 reproduces the elevation of the spire of Eu, covered by its lead work and its slate roofing, the lead work only being applied to the upper termination of the pyramid, the gallery, the dormers and the valleys.

At Evreux on the central tower of masonry, that surmounts the crossing of the cathedral, rises the spire of carpentry covered by lead, very much changed by successive restorations,

but which still presents very good outlines. It is entirely o open from the lantern to the ridge, and that lantern is in t the good style of the 15 th century. The defect of this termination is to be too slender for the masonry shaft; it is badly connected, and the too large number of openings also makes this defect appear more shocking.

One of the most beautiful spires of the 15 th century was that of the S. Chapelle of the palace, rebuilt recently by t the late Lassus after the old drawing preserved in the Imperial Library. This spire is engraved in the Monographie de la S. Chapelle published by M. Bance, with its details of carpentry and leadwork. We request our readers to refer to that work.

But at that epoch architects had already lost that delicate feeling for the outlines of edifices, and they overloaded their entireties with so many labored details, that the masses lost their grandeur. One no longer finds in the spire of S. Chapelle of the palace that inclination of the posts of the lower portion supporting the pyramid; these rise vertically o or nearly so, which makes the entirety heavier and prevents the work from leadiug directly from the ridge of the roof to the apex. The details are at too small a scale, appear confused, and injure the principal lines instead of accenting them. Still we also see on the transepts of the cathedral of Amiens a spire of the beginning of the 16 th century, in the execution of which the qualities mentioned above are developed with rare good fortune.

If the spire of the cathedral of Amiens is a work remarkable in itself, it is not so in relation to the proportions of the edifice; its base is slender, leaves the roof abruptly without transition; the entirety is mean, if one compares it to t the magistral grandeur of the monument. As for the combination of the carpentrw, it sins by the mass of timber and by the lack of simplicity. The carpenters, masters of work, Louis Gordon and Simon Taneau, had the idea of carrying the spire on a platform composed of horizontal crossed timbers made rigid by armed trusses to the number of 10; which produced at the base a mass of timber so great, that one can scarcely pass between the principals of the pendent keys. However well built are t these trusses, this system presents no direct supports, there is always deflection because of the shrinkage of timbers at

ure connections, and consequently figures. The evident inten-
tion of the masters was to establish the eight floor on which
they erected the spire independent of that floor, just as they
[illegible]
the carpentry of the spire of Amiens; the lower platform of
the spire properly so called, which that platform is intended
to support. That requirement accepted, those masters have done
the best possible; but the principle is vicious.

[illegible]
oblique framework. To make the figure less confused, we have as-
sumed the pendant kings to be removed. The two trusses may be
seen to intersect at the principal from which the pendant ki-
ngs support the diagonals at the base of each principal truss.
The great diagonal trusses rest on this superposed floor. As
at Notre Dame of Paris, the portion of the spire has its ang-
les in the valleys and on the intersecting ridges of the roofs.

If we take one of the trusses of the spire perpendicular to
one sides of the square, we obtain Fig. 25. The kingpost or
central axis is at A.[1] At B are [illegible] the trusses
[illegible]
[illegible] parallel [illegible]. The [illegible] of the [illegible]
[illegible] of the relieved [illegible]
[illegible] principal braces [illegible]
[illegible] of the braces. [illegible]
[illegible] of [illegible] 11 [illegible], a second at F, and a th-
[illegible] F of the roofs. It is the
[illegible] framework which receives the first platform of
[illegible] lies immediately at the
level of this [illegible]
[illegible]
[illegible] of isolated posts [illegible]
[illegible] connected
[illegible] or which [illegible]
[illegible] one [illegible] of [illegible]
[illegible], because of the great number of those pieces of
[illegible] lower floor are [illegible]
[illegible] opposite the [illegible] of the
[illegible] the [illegible] on the
[illegible] at [illegible] as [illegible]
[illegible] directly at their feet.

the connections, and consequently flexure. The evident intention of the masters was to establish the rigid floor on which they erected the spire independent of that floor, just as they would have done on the ground. There are then two things in the carpentry of the spire of Amiens; the lower platform of t the spire properly so called, which that platform is intended to support. That requirement accepted, those masters have done the best possible; but the principle is vicious.

Fig. 25 shows in perspective that platform, or rather that bottom framework. To make the Figure less confused, we have assumed the pendant keys to be removed. The ten trusses may be seen to intersect at the principal from which the pendant keys support the tiebeams at the span of each horizontal timber. Two great diagonal tiebeams rest on this suspended floor. As at Notre Dame of Paris, the octagon of the spire has its angles in the valleys and on the intersecting axes of the roofs.

If we take one of the trusses of the spire perpendicular to the sides of the square, we obtain Fig. 26. The kingpost or central axis is at A.[1] At B are traced in section the trusses with pendant keys and opposite is one of these trusses in the plane parallel to our projection. The posts C of the octagon are then supported on the relieved tiebeams of these trusses, as well as the principal braces D. As always, the kingpost is suspended by meetings of the braces. A first horizontal frame composed of doubled timbers is at E, a second at F, and a third at G a little above the ridge H of the roofs. It is the first and last framework which receives the first platform of the spire, so that the open work commences immediately at the level of this ridge; which contributes to give meagerness to the carpentry work, since above the solid mass of the roofs b begins without transition the system of isolated posts allowing the sky to be seen between them. However well connected a are the principals B, or well fastened are the pendant keys supporting the tiebeams, there are numerous causes of shrinkage or loosening, because of the great number of these pieces of wood; it results from this that the lower floor has settled somewhat, particularly at the side opposite the action of the western winds, for one will observe that here the loads on the posts are not distributed at several points as in the carpentry of Notre Dame of Paris, but alt directly at their feet.

Then always a part of this suspended floor is more loaded than the rest, since western winds are most frequent and most violent, especially at Amiens.

The entirety of the system is inclined toward the east, and a little alter the erection there had to be added on that side a long brace, that rests on a truss of the choir very solidly built. The diagonal trusses have little resistance (27); the tiebeam A rests on the lower floor, as seen in the prespective sketch (Fig. 25); but as an additional force the carpenters placed under this floor, that passes in the space B, framed triangles G, whose feet rest on the heads of the four transept piers in the haunches of the vault. These triangles are weakly connected to the system of diagonal trusses, and have tipped under the deflection of the floors. Besides the principal brace E of that half truss is the valley, i.e., it is set at t the line of intersection of the roofs, which gives a position too much inclined to have much strength. If as at Notre Dame of Paris, the carpenters had placed the brace g h above that valley, visible and connected to the triangle C by means of large double timbers m, they would have given to the diagonal trusses much greater resistance, forming great and rigid frames, all parts of which would have been stable.

One will note here, as at Notre Dame of Paris, the posts of the octagon are doubled and strongly inclined toward the axis of the spire. That is a rule from which the architects of the middle ages did not depart in the construction of this sort of edifices.

The outlines of the spire of Notre Dame of Amiens are happy; there is nothing wanting to this carpentry work, except to be on a smaller monument. Fig. 28 presents the elevation of this spire covered by its leadwork. Unfortunately the spire of Amiens has suffered mutilations; its termination was restored in barbarous fashion in the last (18 th) century, after a partial fire caused by lightning. The lead work was partly replaced at the beginning of the 17 th century, and at some places is extremely coarse, concealing the mouldings or the perforations in the woodwork.

The section of the pyramid does not give the octagon with straight sides, but with concave curved sides (see detail A), so as to obtain lines of light and shadow, as we have said

above, and to study the old effect produced by operating with old stone, when they are placed at a great height and lighted by the sun. Some original parts of the lead work are very remarkable.

In summary, if the spire of Notre Dame of Amiens is not an [illegible] work, it deserves careful study; besides it is the only one of these dimensions still existing in France. Including the lead, its weight is 551 tons. Its height above the ground (level 0) to the ball was [illegible] ft.; it is now only 147.6 ft. The timbers are of good quality, heart of oak. Formerly the lead work was painted and gilded; numerous traces of that [illegible].

We shall also give among the belfry spires covered by lead, some of Notre Dame of Chalons-sur-Marne, that are from the end of the 14 th century, the very simple one of very beautiful form, [illegible] the end of the 15 th century; [illegible] of the cathedral of Reims, a work dating from the end of the 15 th century, and whose lead work is very well preserved. (Art. Flecherie).

[illegible]

[illegible]

[illegible] certain figures of some accessories, [illegible]. It [illegible] from the 12 th century, [illegible] the [illegible] of certain [illegible] were [illegible] by means of plant [illegible], as [illegible] the [illegible] of [illegible] its rivals, this was [illegible] of [illegible] seen in the gardens of the [illegible]

[illegible] is not [illegible], as in many other [illegible], the [illegible] of the [illegible]

[illegible]

above, and to avoid the bad effect produced by pyramids with plane sides, when they are placed at a great height and lighted by the sun. Some original parts of the lead work are very remarkable.

In summary, if the spire of Notre Dame of Amiens is not an irreproachable work, it however merits study; besides it is the only one of those dimensions still existing in France. Including the lead, its weight is 551 tons. Its height above the ridge (level B) to the ball was 154 ft.; it is now only 147.6 ft. The timbers are of good quality, heart of oak. Formerly the lead work was painted and gilded; numerous traces of that decoration are to be seen.

We shall also cite among the carpentry spires covered by l lead those of Notre Dame of Chalons-sur-Marne, that are from the end of the 14 th century, are very simple but of very beautiful form, and that crown stone towers of the end of the 12 th century; that of the hip of the cathedral of Rheims, w which dates from the end of the 15 th century, and whose lead work is very well preserved. (Art. Plomberie).

FLEUR. Flower. (Art. Flore).

FLEURON. Cross-flower. Plant Ornament.

A plant form terminating certain members of Gothic architecture, such as pinnacler, gables, canopies, cusps, etc. It appears in architecture only in the 12 th century, i.e., at the moment when the lay school seeks the ornamentation of its edifices in the flora of the country. From Grecian antiquity the roofs of certain edifices were terminated by means of plant decorations, as one can recognize in examining the choragic monument of Lysicrates at Athens. Although in that case the termination was probably intended to support the tripod that recalled the victory of Lysicrates over his rivals, this was no less a crowning borrowed from the plant kingdom. The celebrated pine cone of bronze seen in the gardens of the Vatican is an actual ornament terminating a great antique monument. The idea is not new, and in that as in many other things, the Gothicarchitects followed a very ancient tradition transmitted to them by the masters of the Romanesque school.

But what is new and belongs to those Gothic architects is t

the particular character given to those terminations, their f frank appearance of plant forms. One sees well characterized cross flowers appear at the summits of the pinnacles and dormers of the old tower of the cathedral of Chartres (middle of 12 th century); at least these are the oldest that have remained to us. Although deteriorated by time, these cross flowers allow their primitive form to be seen. They abruptly leave the tops of the angles of these pinnacles without intermediate rings; they present (1) a combination of young leaves and buds ending in human heads. The sculpture is broad and coarse, as proper for such a height. The entire ornament is c cut in a single stone more than 3.3 ft. high.

Yet the study of plants soon leads architects to seek in t the various members of plants those, that lend themselves best to that form of termination; they observe that the pistils of flowers, for example, often give regular ornament, perfectly appropriate to the end and apex; they see that these pistils are habitually accompanied by a collar and appendages. Then they render these plant forms without seeking too much to servilely imitate nature; they seize on the character of power and vivacity, and compose terminals like this (2), which dates from the last years of the 12 th century, and comes from the lower gablets of the buttresses of the cathedral of Paris (north side). This simple form does not seem to them to present an outline sufficiently cut out, and those artists had recourse to nature, separating more the leaflets accompanying the pistil (3),[1] so as to obtain expansion; or indeed a little later (about 1220), they seek to imitate buds (4);[2] they dissect them and remove certain parts, as indicated by this crown A of truncated petioles, and disengage the principal s stem B; then they begin to combine with this vegetation geometrical forms, architectural mouldings without the ring imitated from the fruit. While carefully studying plants, the sculptors of the beginning of the 13 th century do not copy them servilely; they subject them to monumental arrangements, to t the scale of the architecture. From the imitation of the pistil of flowers, grains and buds, they soon come to the imitation of the developed leaf, but always subjecting that imitation to the decorative requirements suited to sculpture on stone (5).[1] They know how to unite the balance of the masses w

with the freedom of the plant.

Note 1.p.473. From gablets of the buttresses of the towers of the cathedral of Paris.

Note 2.p.473. From the facade of the abbey church of Vezelay.

Note 1.p.474. From the cathedral of Troyes (about 1225).

From the beginning of the 13 th century, the stems of the ornament show square or octagonal sections; this stem is divided into four leaves in a single tier with the upper bud, or into two tiers. In the last case the leaves of the second row alternate with those of the first, so as to oppose the lines produced in perspective, to give more movement and more effect to those ornamental terminations, as indicated by Fig. 6, and to restore the vertical line by the contrast of shadows and lights. Frequently the endings of cross flowers are nothing m more than crockets, like those accompanying the rakes of gables or pinnacles (7).[1]

Note 1.p.475. From the cathedral of Amiens, facade (about 1230).

About the middle op the 13 th century cross flowers of great dimensions bear two rows of leaves. All the architectural members tending to rise, to make the vertical line dominate, it was necessary to give increasing importance to these terminations of the acute parts of edifices. The imitation of plants became more scrupulous, more refined, but also less monumental. This vegetation did not belong to the stone but was like an addition; it was no longer the stone that expanded, but indeed leaves surrounding a nucleus of geometrical form (8).[1] What cannot be too much admired in these terminals of gables and pinnacles is their just proportion to the architectural members, that they crown. There is an ease and grace, a delicacy of contour, a firmness in these terminations, very difficult for us to reproduce, accustomed as we are to the dry and common ornamentation of modern times. Yes, because of the false rendition of the antique sculpture, we tend to conventional ornament, symmetrical, dead and fossil, copied from copies; or we launch into the domains of caprice and fantasy, because for a century artists possessing more fancy than taste have o opened to us this dangerous path. Just as caprice is sometimes seductive, when it appears naturally and is a freak of the spirit, just so much is it wearisome if labored. The ornaments

furnished to us by this Article (ornaments of singular importance, since they serve as terminations of the dominant parts of edifices). are not the result of caprice, but indeed of t the attentive and refined study of plants. There is a Gothic flora with its laws of harmony, its reason for existence, so to speak, like the natural flora; it is found on bands, capitals, and particularly on these terminal'cross flowers, so visible and frequently detached agains the sky, whose outlines, relief and charm, can spoil a monument or give it an attractive appearauce. The variety of cross flowers of the 13 th century is infinite, for although our edifices of that epoch may be covered by them, no two are known, sculptured from the same model. So we can present to our readers only a small number, selecting those distinguished by particular arrangement or by great perfection of execution.

Note 1.p.476. From the north portal of the cathedral of Paris (1260).

In the edifices of Ile-de-France and of Champagne, these cross flowers are incomparably more beautiful and varied than in the other provinces; they are also better proportioned, mo more broadly designed and executed. Those in great number to be seen around the cathedral of Paris, those of the tomb of Dagobert at S. Denis, those of the church af Poissy (9) that terminate the flying buttresses of the choir, those of the cathedral of Rheims (we are speaking of the old ones) are for the most part in a good style and executed by the hand of a master.

Around the upper balustrades of Notre Dame of Paris can be seen cross flowers on square bases and terminating the pilasters, that have an incomparable breadth of style (Art. Balustrade, Fig. 10). Those of the external balustrade of the gallery of the choir, whose fragments we collected, had a character of power and energy, that one finds expressed to the same degree in no other monument of that epoch. (Beginning of the 13 th century). (10).

About the end of the 13 th century these ornaments became more leafy, servilely imitating the flora, then adopting forms all especially borrowed from the excresences of the oak leaf (gall nuts) and water leaf. This transition is sensible in the church of S. Urbain of Troyes, erected during the last

years of the 13 th century. The great cross flowers with three rows of leaves, that terminate the gables of windows, are carved with boldness and ease that reaches exaggeration (11).

During the 14 th century cross flowers are usually composed only of the combination of four or eight crockets following t the forms given to this ornament. The decoration at that epoch becomes monotonous like the lines of the architecture. Yet t the cross flowers are sculptured with remarkable spirit and life (12). One sees quite beautiful cross flowers at the cathedral of Amiens, around that of Paris, at S. Ouen of Rouen, S. Etienne of Auxerre, the cathedral of Clermont, S. Just of Narbonne, and S. Nazaire of Carcassonne; but the great defect of the sculpture of the 14 th century is the lack of variety, and this defect is particularly offensive, when concerniug t the terminations, all viewed under nearly the same conditions.

In the 15 th century the cross flowers terminating the pinnacles or gables are often despoiled of foliage and are simple terminations of geometrical forms in the style of Fig. 13. Y Yet if the edifice be very richly sculptured, for example like around the choir of the abbey church of Eu, these terminations are covered by water leaves or rather by ornament strongly resembling marine algae (14). About 1500, cross flowers are nothing but a combination of the crockets of the rakes of gables or pinnacles, and they end in a long prismatic stem. (Arts. Contre-Courbe, Fig. 2; Crocket; Fenetre, Fig. 42; Gable; Pinacle).

The same name (fleuron) is given to the expansions of leaves terminatiug cusps. (Art. Redent).

Whether the cross flowers belong to the 13 th or the 15 th centuries, they are always well placed, boldly outlined, in p perfect proportion to the parts of the architecture that they surmount. Gothic architects knew how to crown their edifices. One must the more be devoted to these qualities, because today most of our modern monuments evidently sin by the contrary defect. The classical era, which has ended, regarded these terminations as the excess of bad taste. The Greeks and Romans h however did not fail to terminate the upper parts of their edifices by ornaments in stone, marble or metal, that were detached against the sky; but the examples no longer exist in p place, and it was agreed that antique architecture could do

without those accessories. This was a cause of [illegible] the difficulty, but gradually archeologists, examination of the scattered fragments and debris, have made it recognized that the sculptors were far from depriving themselves of these ornamental resources; thus [illegible] seek timidly and rather by chance to break the dry and cold lines of our palaces, our [illegible] surface; not when it concerns outlines, that the necessary are cold lines, a sure eye, exact and decorative effect, preservation of the play of shadows. This excellence must be recognized, for we have absolutely lost it.

[illegible]

We have forgotten [illegible] to speak of the sculpture [illegible] of the ornaments of the middle age; and [illegible] [illegible] [illegible], [illegible] it is [illegible] we had had advanced any further. [illegible] the [illegible] of the Roman and Ro[illegible]; yet [illegible] the [illegible] of the 12th century in Gothic [illegible] a [illegible] each [illegible] of [illegible] about the [illegible] of the [illegible] and [illegible]. But [illegible] this [illegible] how has it [illegible], and succeeded in [illegible] a [illegible] to form a history of the [illegible], even if it really [illegible] nothing [illegible] the past.

[illegible], it seems that the [illegible] of [illegible], that could it [illegible] the elements of [illegible]. The [illegible] of the [illegible] of [illegible] and [illegible] to [illegible] [illegible] is [illegible], the [illegible] of [illegible]. In [illegible] parts of the [illegible], [illegible], an the [illegible] of the 12th century, sculpture is [illegible]. These [illegible] are [illegible]; they [illegible] to [illegible], [illegible] types, [illegible] no longer [illegible], because they [illegible].

without those accessories. That was a means of eluding the difficulty. But gradually archaeologists, examination of the scattered fragments and medals, have made it recognized that the ancients were far from depriving themselves of these ornamental resources; thus men seek timidly and rather by chance to break the dry and cold lines of our palaces, our public e edifices; now when it concerns outlines, what are necessary are bold lines, a sure eye, experience anf perspective effect, observation of the play of shadows. That experience must be acquired, for we have absolutely lost it.

FLORE. Flora.

We have frequently had occasion to speak of the sculptured flora of the architecture of the middle ages; that is indeed because that architecture possesser its flora, that is modified as the art advancer and declines. During the Romanesque period, the flora is merely an imitation of the Roman and Byzantine sculpture; yet one perceives about the beginning of the 12 th century in certain Roman edifices a manifest tendency to seek models of sculptured ornamentation among the plants of t the forests and fields. But how did that search commence? To what elements was it attached at first? What originated it? How was it erected into a system, and succeeded in forming a school? To solve these questions is to form a history of our French art at the moment when it develops, when it is really original and borrows nothiug from the past.

In examiniug the monuments, it seems that the Cluniacs were the first to form schools of sculpturs, that sought in natural productions the elements of their decoration. The capitals of the nave of the abbey church of Vezelay are already no longer debased imitations of antique sculpture; their sculptured vegetation possesses an appearance suited to it, which has r ruggedness in the new art rather than the barbarous impression of an art, the last reflection of aged traditions. On the banks of the Loire and Garonne, in Poitou and Saintonge, at the beginning of the 12 th century, sculpture is seen to seek elements other than those left by antiquity. These experiments are however partial; they appear to belong to isolated artists, wearied by always reproducing types, whose sense they no longer undeestood, because they knew not their origin. How-

However this may be, those experiments have a certain importance; they opened the way for the new school of lay architects; this is at least probable.

We present at first one of those examples, that will emphasige in the clearest manner what we are going to say. We give here the capital from the abbey church of Bourg-Dieu near Chateauroux, whose sculpture dates from about 1130. (1).

Here are seen leaves of fern at the moment when they begin to expand, to leave their downy tissue. We believe there is no need to cause to be noted in this capital the evident intention of the artist; he certaiuly desired to use these strong forms given by those sprays of fern, that are found everywhere iu France under the great trees. The sculptor is inspired by neither Roman traditions nor Byzantine ornaments; he has gathered the sprig of fern, has examined it carefully, is moved by a passion for those charming natural productions, and then he has composed his capital. Let us in our turn note this Fig. 2; we shall have occasion to return to it. This is for that epoch, we repeat, an isolated fact. But soon the lay school of architects arises, takes possession of all constructions, particalarly in the royal domain. From its first steps, one feels that this school desires to break with the traditions of art and of the works. Perhaps there was ingratitude in that procedure, since this school was raised beneath the vaults of the cloisters, but that is of little importance to us today. As a system of constructiou (Arts. Cathedrale; Construction), as a method of building, the lay architects of the second half of the 12 th century seek to break with monastic traditions. The forms they adopt, the mouldings they drew, the profiles they cut, and the ornaments they carve, are based on principles foreign to Roman art; observation and research replace the tradition. When it concerns ornaments, they no longer wish to consider old capitals of Romanesque friezes; they go into the forests and the fields, they seek the smallest plants under the grass; they examine their sprays, buds, flowers and fruits, and see them with this humble flora compose an i infinite variety of ornaments with a grandeur of style and fo firm execution, that leaves very distant the best examples of Romanesque sculpture. Whether instinct or reasoning, those a artists understand that the smallest plants, like insects, are

endowed with organs relatively much stronger than those of gr-great animals; destined to live in the same locality, to resist the same agents, foreseeing nature indeed has given to its humblest creations a strength relativelw superior to that of the great beings. The forms of the smallest insects, like those of the smallest plants, have energy, a purity of lines, a vigor of organization, that lends itself marvellously to express grandeur and force; while on the contrary one notes, particularly in the forms of great plants a sort of indecision and weakness, that cannot supply examples of monumental sculpture. Besides, who knows? Those lay artists who arose in France at the end of the 12 th century, and that rose in the midst of a badly constituted society, those artists scarcely understood in their time and very little today, perhaps found a certain charm in surrounding their art with mystery; just as they transmitted their great principles in the shadow of a sort of freemasonry, and also in seeking their ornamental motives along the banks of brooks, in the meadows and the depth of forests, in the lowest plant productions, allowed themselves to be guided by that instinct of the poet, who does not desire to show common men the secrets of his conceptions. True art has its modesty; it conceals its fertile loves from sight. Who knows if those artists did not find intimate joy in the monumental reproduction of those humble plants, known to and loved by th-them alone, gathered and long studied in the silence of the forest? These reflections came to us frequently in examining the marvellous developments of plants lost in the grass, their efforts to repel the ground, the vital strength of their sprays, the energetic lines of their growing shoots, the forms of the beautiful ornaments of the first Gothic period returned to our memory. Since we are going to seek the elements of an art in those lowest productions, upon which nature seems to have cast one of her mildest looks, why have not others before us have done this also? Why have not observing artists, wearied by the monotony of Romanesque art, been charmed by this modest flor af the fields, and seeking an art, why have they not said on discovering these concealed treasures; "I have found it?" Once in that path, we have followed step by step and not without a lively interest the ingenious interpretations of our predecessors; our examination has led us to singular results. We

We recognized that the first artists (it is understood that we speak here only of the lay school, that arose from 1140 to 1180 in Ile-de-France and adjacent provinces) were led to imitate the appearance of those modest plants of the fields at the moment that they developed, when the leaves scarcely leave their shoots, the buds appear or the thick stems filled with sap have attained their growth; that they have been to s seek as motives of ornaments embryos, or again pistils, berries, and even the stamens of flowers. With these elements they composed those great capitals, that we admire around the choir of Notre Dame of Paris, in church S. Julien-le-Pauvre, that of S. Quiriace of Provins, Sens and Senlis, of S. Leu of Esserent, in the choir of Vezelay, the church of Montreale, at Notre Dame of Chalons-sur-Marne, and around the sanctuary of S. Remy of Rheims. Soon (for we know that those artists do not stop in the way) from imitation of the growing flora they pass to the imitation of the developed flora; the stems lengthen and become smaller; the leaves open and spread; the buds become f flowers and fruits. Later those artists forget their humble primitive models; they seek their examples on the shrubs; they take possession of the ivy, vine, holly, mallow, sweetbrier and maple. At the end of the 13 th century they copy servilely the oak, wild plum, fig, pear, as well as the leaves of t the waterleaf, bindweed, parsley, and herbaceous plants, as w well as the foliage of the great trees of our forests; all is good to them, all is for them a motive of ornament. Let us say at once, that the imitation approaches more nearly the reality as Gothic art advances toward its decadence. At the end of the 12 th century and also at the beginning of the 13 th, this imitation is subject to monumental requirements, that lend to the sculpture a special beauty. Let us also state that this sculpture is greater, broader, more powerful and finally monumental, when it seeks its inspirations among the most modest plants; while it falls into dryness and leanness when it desires to copy the leaves of great plants.

The lay artists of the 12 th centurw in using these plants seized on their principal charcaters and appearance; these b became for them the subject of inspiration rather than an ordinary model. But let us take some examples. For example, it is evident that the scrolls which decorate one side of the m

mullion of the middle portal of the cathedral of Sens (about 1170) were inspired by those young sprays of fern, some sprigs of which we have given above, and those of the shooting leaves of plantain (3), have they inspired artists who sculptured t the capitals of the choir of Vezelay, those of the gallery of the choir of Notre Dame of Paris (3 bis), or those of the church of Contreal (4)? Is there not a great analogy between th those little scarcely developed flowers of coronilla (5) aud the primitive crockets decorating the angles of those capitals? The section of one of those plantain leaves (Fig. 3) made on a b and sketched at A, is faithfully observed in the sculptures given here.

Before carrying farther the examination of the monumental flora of the lay school, it is necessary to render an exact account of the mixture made during the Romanesque period, of antique traditions with certaiu forms evidently inspired by some plants of our forests. Writers have already stated very ingenious observations on this subject, however without strengthening these observations by studied Figs.; some claim that the ornaments, that in the 12 th century came to form what is called the fleur-de-lis, were inspired by the iris or gladiola; others that those carved and painted ornaments, so common from the end of the 11 th century, are a reminiscence of arum plants. We leave to all to judge of the process, and we shall l limit ourselves to supplying the examples; thus indeed in our opinion, it matters little whether the sculptors of the 11 th and 12 th centuries copied the iris or the arum; the question is to know whether those sculptors have added something to the worn-out traditions of the Romanesque arts in their ornamentation. The fact does not seem doubtful.

Let us first take the Aracae, that appear to have inspired our sculptors from a very ancient epoch.

According to Jussieu, the Aracae are "plants with tuberous roots, with leaves simple, alternate, sheathing; flowers monoecious, joined with a true colored spathe, with or without a special perianth; fruit bacciform."

Arum maculatum, commonly known by the name of"gouet"or calfsfoot, bears an erect stem, nude, about 8 ins. high, smooth; leaves are radical and borne on long petioles, large, sagittate-cordiform, as if truncated obliquely at both sides at the

base, entire, without spots, smooth; the terminal spathe is elongated and pointed; the spadix is shorter that that; in r ripening, the part above the berry falls; there remain numerous berries, red and contain two rough seeds. The flowers (pathes) are light green and turn violet in fading. The arum appears in April and May, and is very common in damp forests of the vicinity of Paris, Champagne and Burgundy.

Since it is not certain that all architects may be botanists, we give here a representation of the arum. At A the spathe is closed; it still envelops the spadix. At B the entire plant is shown with its tuberous root; the spathe is developed, is opened and allows the spadix to be seen. The leaves are sagittate. At C is given a section of the spathe, permitting to be seen the entire spadix with its stamens and its pistils at t the base. When the fruit is ripe, D, the upper part of the s spadix is destroyed; the spathe remains in the state of a fragment, E. At F is one of the stamens. No person walking in t the forest in spring has not examined this plant of a remarkable appearance, already expanded when trees and shrubs bear som tender leaves scarcely out of the buds. The arum and the iris are the first signs of the return of fine weather. Is it for that the Romanesque scalptors seem to have loved these p plants, as the revival of nature? Is it necessary to attach t to the imitation of aracae a symbolic idea, to see in it an antique tradition? We shall refrain from deciding the question. The fact is that in the sculptures of the end of the 11 th c century, we find the evident trace of that imitation. The beautiful capitals of the nave of the abbey church of Vezelay s show us imitations of the aracae (7), which terminate foliage more or less derived from the Roman sculpture of the Corinthian c column. At A is developed the spathe of arum and the end of the spadix has fallen, the berries remaining visible. At B t the leaves of the arum are rolled in volutes or crockets at the angles of a capital. In Fig. 7 bis, the sculptor has doubled the spadix at A, but left it single at B; but in both cases the spathe encloses the fruit.

These plants of marshy forests do not seem to be the only ones that inspired Romanesque sculptors; we see that they have a particular affection for the water lily, and for the water leaf. Two other capitals of the nave of vezelay also present

in the form of spad

in form of crockets withered leaves of water lilies, with or without flowers (8). One knows how rapidly water plants wither when gathered; in example A it appears that the sculptur, to decorate the angle of his capital, suspended near him the leaves of the water lilies so common in our ponds, and that they have closed together, as soon occurs when they cannot l longer extend on the surface of the water.

These imitations are very free, such as occur among primitive artists, but they scarcely appear doubtful. Indeed it is unnecessary to reproduce a certain plant with all the care of the naturalist, but to find a motive for ornament. Besides, the eyes of naive observers are satisfied by an interpretation, and daily we see children for whom a puppet roughly carved in a bit of wood is the complete image of a personage. Indeed it must also have recognized that style in the arts, for ornaments as well as for everything borrowed from nature, demands interpretation rather than scrupulous imitation of the object. Plants have a charm and appearance of pose, that strike the inexperienced observer at once. He seizes its general characters without going beyond that; he produces a second c creation that becomes a work of art, although one finds in t that second creation the powerful imprint of nature. Romanesque artists adhered to those primitive inspirations; they even corrupt them as their hands acquire skill, and it is interesting to see how, when the art becomes lay, the spirit of examination is promptly introduced into the sculpture of ornament; how free inspiration, or that subject to certain traditions of the profession, is soon suffocated by the desire of arriving at the servile imitation of nature.

Let us now say a word of the flower of the iris, that also enjoys a great part in the Romanesque ornamentation of the 11 th and 12 th centuries. The flower of iris is enveloped in a membraneous spathe before its expansion. According to Linnaeus, "the corolla has six deep divisions, alternately expanded and reflexed; the style is short, bearing three narrow petaloids, often emarginated, which takes the place of stigmas; the lower capsule has three valves, with three polyspermous cells."

Here (9) is an iris flower, known under the name of flag, drawn at natural size. If we present this flower so as to ma-

make its different parts regular, we obtain Fig. 10. The six divisions of the corolla are visible as A A, B B, C C. Two of the narrow petalloids are visible at D, the third being found on the axis of the flower. The spathe is at E. From this form of the ornament known under the name of fleur-de-lis is not far. In the Romanesque ornaments of the 12 th century (11,[1] 12 and 13 [2]) is recognized the attempts of artists seeking to inspire themselves by the general forms of the flower of the iris, while retaining the style of degenerate Roman art. Those artists especially love the arum and the iris; from the b beginning of the 12 th century, these two plants give a particular appearance to sculptured or painted ornamentation (Art. Peinture). What was the reason that caused the selection of t these plants of wet places, that flower in the first days of spring? M. Woillez, author of a very interesting pamphlet on this subject,[1] does not hesitate to see in that imitation of araceous plants a symbolical idea of power. He sees there a r relic of paganism, and expresses himself thus:- [2] "I think t that the arum, the actual type of the botanical family araceae, or another plant of the same kind,[3] became in some sense the phallus transfigured by Christianity. The simple rustic appellation of the plant in certain places in Picardy, and notably in the vicinity of Clermont, sufficed to suggest to me this o opinion. I knew that this plant, concealed beneath wet and sh shady forests, eccentric in its external forms, was in great credit among magicians and enchanters of the middle ages, when I learned its most common name. This appellation corresponds to the Latin words "presbiteri phallus;" the spadix enveloped by its green spathe is still called "vicar", while at the moment of fertilization and when this spadix has taken a violet tint, it is "priest". The arum may be called a plant phallus, and is one of the plants first announcing the return of vegetation, or like the phallus properly so called, the revival of nature; it indeed could be the expression or emblem of the imperishable generative power, since annually and without previous culture, one sees it pierce the earth, then disappear after fructification, to reappear after the succeeding winter. But further, like the phallus, it has figured as the attribute of power in general, which will prove its identity with that." M. Woillez recalls in connection the note of Dr. Colson [4] on

a medal of Julia Mammea, on the reverse of which is seen Juno holding a phallus in one hand and in the other a lily, and it is to be stated indeed, that the first sceptres borne by kings or even the Holy Virgin are terminated by the arum flower or lily flower quite similar to that we have given above (Fig. 1 10), only M. Woillez sees in these ornaments only imitations of the plants of the araceae. I think that one finds there b both the arum and the iris; even sometimes, as in ornament, (Fig. 13), the combination of the two spring plants. However it does not seem to us in the present state of actual knowledge, that one can give as assured facts the influence of those pagan traditions of high antiquity in the arts of the middle ages.

Note 1.p.495. Museum of Toulouse (frieze).

Note 2.p.495. Capitals deposited in the storerooms of the imperial church of S. Denis.

Note 1.p.497. Iconog.d.pl.aroides fig.au M.A. en Picardie, et cons. comme orig.d.l.fleur-de-lis de France. Amiens.1848.

Note 2.p.497. Page 41.

Note 3.p.497. As we have just shown, the iris served as a type for Romanesque sculptors.

Note 4.p.497. Mem.d.l.soc.d.antiq.d.Picardie. Vol.VIII.p.245.

If the sculptured Romanesque flora combined with the last r remains of Roman arts the new inspiretion aroused by the observation of the spring plants of the forests, it also suffered the influence of the arts of the East. During the 10 th, 11 th and 12 th centuries many articles brought frsm Byzantium and Syria filled the treasuries of the monasteries of Paris; fabrics, ivory carvings, utensils, furniture, came in great number from the East and supplied French artists with motives of ornaments that they interpreted in their own manner. Many of these Byzantine ornaments were themselves borrowed from the eastern flora. Then it should not be surprising to find on o our capitals and friezes of the 11 th and 12 th centuries forms recalling certain plants then unknown in the West. (Art. Sculpture).

Such were the different sources from which Romanesque sculptors had drawn, when there appeared the lay school of the second half of the 12 th century; this school could not break a abruptly with that preceding it. In the same edifice is seen

as the cathedral of Paris, around the [illegible] of the [illegible]

[illegible]

of Romanesque [illegible] besides [illegible] in a [illegible]

[illegible] those [illegible], collected in the French flora.

These are the leaves of columbine, [illegible], [illegible],

[illegible]

[illegible], sorrel, violet, [illegible], fern and vine; the flowers

of [illegible], [illegible], [illegible], water lily, [illegible], [illegible],

[illegible], [illegible], [illegible] of the valley; the flowers, fruits

or [illegible] of the [illegible], [illegible], flax, [illegible], some roses,

[illegible], [illegible], [illegible], iris and [illegible], which [illegible]

[illegible] of [illegible]. But one should not [illegible] the

value of our [illegible], for these artists were not botanists;

if they seem to [illegible] the [illegible] of certain plants, they

do not [illegible] themselves to [illegible] accuracy; they do not make

the error of minute [illegible], of [illegible] that from one plant,

a leaf from another, a [illegible] from a third [illegible]; they observe

with [illegible] only the principal [illegible] to the [illegible],

the [illegible] of the leaves, the [illegible] and [illegible] of

the [illegible], the [illegible], the [illegible] and [illegible] of the

[illegible], [illegible] or flowers; they [illegible] a flora that belongs

to them, [illegible] which [illegible] it [illegible], [illegible] a [illegible]

[illegible] full of life and [illegible]. That [illegible] [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible], while the [illegible] of the end of the 12th [illegible]

to [illegible] to [illegible] the [illegible]. Not only [illegible] in [illegible]

[illegible] [illegible], [illegible] this is [illegible] [illegible]

[illegible], always alive and [illegible]. [illegible]

[illegible] school of [illegible]; [illegible]

[illegible] new [illegible], [illegible]

[illegible] [illegible] and in every [illegible]. [illegible]

[illegible], [illegible]; [illegible]

as at the cathedral of Paris, around the choir of the church of S. Leu of Esserent and at Noyon, sculpturs still impressed by Romanesque traditions beside ornaments in a style entirely foreign to those traditions, collected in the French flora. These are the leaves of columbine, aristolochia, primrose, b buttercup, plantain, toadflax, celandine, hepatica, cress, g geranium, sorrel, violet, rumex, fern and vine; the flowers of snapdragon, monkshood, pea, water lily, rue, broom, orchid, gourd, iris, saffron, lily of the valley; the flowers, fruits or pistils of the poppy, polygala, flax, mallow, some roses, marigold, euphorbia, alisma, iris and colchicum, which inspired the sculptors of ornament. But one should not mistake the value of our statement, for those artists were not botanists; if they seek to render the appearance of certain plants, they do not pride themselves on organic accuracy; they do not make the error of mixing species, of taking a bud from one plant, a leaf from another, a shoot from still another; they observe with scrupulous care the principal characters op the plants, the modeling of the leaves, the curvature and diminution of the twigs, the junctions, the pure aud firm contours of the pistils, fruits or flowers; they create a flora that belongs to them, but which however monumental it is, retains a character of likeness full of life and energy. That monumental flora has its laws, development and charm; it is an art in brief and not an imitation. We are today so far from the path pursued at all fine epochs, that some efforts are necessary for us to understand the power and that creation of the second order, as far distaut from servile imitation and commonness as from pure fancy. Our monuments are covered by imitations of Roman ornamentation, which is only a mistaken copy of the monumental flora of the Greeks; we copy the copies of copies at great cost; our architectural ornamentation falls into vulgarity, while the lay school of the end of the 12 th century goes to the sources to seek its inspirations. Not only does it thus find an original ornamentation, but this is based on a principle ever new, always alive and applicable. French art of the great lay school of architecture is logical; in its construction it establishes new principles, that without imposing a f form, are applicable everywhere and in every time. In decoration, this art only established principles; it did not prescribe

the use of a hieratic form like oriental art. The genius of each artist can constantly derive from those fruitful principles new and unforeseen forms. In our days has been restored in France method, the declaration of principles by teaching, not by reasoning, of one or several forms of art; one of the applications of the principle has been taken for the art itself, and then men said with much reason:- "All imitation is bad; if we proscribe the imitation of the arts of antiquity, we cannot prescribe the imitation of the arts of the middle ages." But replacing the teaching of such a form, of application of the principle, by teaching the principle itself, one does not prescribe imitation, but only employs a true method, that allows everyone to follow his inspirations. We know well that it is a school for which principles are an embarrassment; it desires fancy alone to be the sole guide of the artist. C Caprice has charming turns when it is only the polish of a re-reflective and observing mind, when it covers with a vestment with a thousand unforeseen reflections a solid body, well made and healthy; but nothing is more monotonous and wearying than caprice when it is alone and only covers an inconsistent, wretched and poor body. There is certainly much fancy in the architectural ornamentation of our French school. But it only plays around principles, substantial and true, derived from acute observation of nature; fancy is then only grace, that knows how to avoid pedantry. Let us pursue our study.

Here (14) is a very common plant, the cress. Then examine with attention those supple and fleshy stems, those petioles well joined, those graceful curves of the branches and their detail A. Yet in these branches is an indecision of contour, which does not lend itself to monumental decoration; the stipules B throw confusion into the midst of the masses. To make an ornament with this plant it is necessary to sacrifice something, to give firmness to the outlines of the petioles; it is necessary to take and to leave, to add and to omit; what it is necessary to retain is the accent and grace, flexibility and ease of the outlines. With incomparable skill, the sculptors of Notre Dame of Paris have attained that result (15).[1] While retaining the outlines of those leaves of cress, they have gi given them an accent, firm, monumental and precise; between these branches they have added clusters to give grandeur and

at the same time refinement of the orient. They have spent and studied nature, and have derived from it a new direction. [illegible] original, living and well composed as in a composition executed with skill. This makes itself observed, like every work in which art is based on nature without merely copying it.

Note 1.p.499. Western portal of the cathedral of Paris, first years of 12 th century.

Let us also examine this leaf of celandine (16), seen a common plant in our fields; these leaves are deeply divided, [illegible] brous ribs are marked and thick; the lateral petioles are developed. It is a matter of interesting this plant, beautiful by its general form and by its details. The same sculptors compose the ornament (17).[1] They reserve the upper leaflet on itself and double it by the second leaf to increase its mass. They note the two lateral [illegible] they obtain already the petiole; they retain [illegible] eyes, which give a particular character to the leaf of the celandine, which reduces them, and exaggerate the thickness of this fibrous and almost flat; then in fig. 15 the cross section of one of the petioles gives the section A; B being the bottom of the leaf, they adopt the section C in their sculpture. [illegible] the botanical exactness, they [illegible] themselves to monumental ornamentation, that only details which are [illegible] or weakens the sculpture. Although seeking absolute symmetry, still they avoid the uncertain irregularities of the plant. They compose the ornament with several [illegible] of leaves, but they have sufficiently observed nature to give possibility to their compositions. Many of these [illegible] are monsters from the point of view of [illegible], but others are considered created as likely to live. We find again these same qualities in the sculptures of the [illegible] century, which they compose [illegible]

Note 1.p.502. From Notre Dame of Paris. This ornament is found under the statues of the portal of the right of the [illegible] treasury; beginning of the 13 th century.

If these artists do not possess the science of the botanist, if they do not accurately copy a certain plant or portion of a plant, yet they have observed with [illegible] certain organic

at the same time refinement of the ornament. They have seen and studied nature, and have derived from it a new creation. Here are no traditions of Roman or Byzantine ornaments; this is original, living and well comprised as in a composition executed with skill. This makes itself apparent, like every work in which art is based on nature without merely copying it.

Note 1.p.499. Western portal of the cathedral of Paris, first years of 13 th century.

Let us also examine this leaf of celandine (16), such a common plant in our fields; these leaves are deeply divided, with oval leaflets, toothed and with rounded lobes; their fibrous ribs are marked and thick; the lateral stipules are developed. It is a matter of interpreting this plant, beautiful by its general form and by its details. The same sculptors compose the ornament (17).[1] They recurve the upper leaflet on itself and double it by the second leaf to increase its mass. They note the two lateral stipules; they broaden properly the petiole; they retain those eyes, which give a particular character to the leaf of the celandine, those rounded lobes; they exaggerate the structure of this fibrous and strong rib; then in Fig. 16 the cross section of one of the stipules gives the sketch A; B being the bottom of the leaf, they adopt the section C in their sculpture. Always attentive to seize and accent the principal characters, that lend themselves to monumental ornamentation, they omit details whose reproduction dwarfs or weakens the sculpture. Without seeking absolute symmetry, still they avoid the uncertain irregularities of the plant. They compose the ornament with several members of plants, but they have sufficiently observed nature to give probability to their compositions. Many of these inspirations are monsters from the point of view of science, but these are monsters created as likely to live. We find again those same qualities in the sculptures of the 13 th century, when they compose fanciful animals. (Arts. Sculpture; Gargouille).

Note 1.p.502. From Notre Dame of Paris. This ornament is f found under the statues of the portal at the right of the buttresses; beginning of the 13 th century.

If those artists do not possess the science of the botanist, if they do not accurately copy a certain plant or portion of a plant, yet they have observed with delicacy certain organic

laws from which they do not wander; they know the anatomy of the plant and follow its general rules; thus the fibrous ribs, the skeleton of the leaf, is always arranged in a probable manner; the modeling of the leaf is delicately rendered, and as we have said above, by preference is inspired by those little plants, whose strength of organization is relatively more developed than in great ones, and with more characteristic f forms, simpler and firmer in style.

For example, in Fig. 18, that gives us at A leaves of the family of Schrophulariacae,[1] the last leaf B is recurved when it has just left the bud; while this leaf from the Umbelliferae C, of natural size, is well divided, strong and broadly modeled. By the aid of these humble plants, our sculptures of the 13 th century have composed the frieze of monumental appearance, energetic and grand. The little leaf B supplied them with the motive of those crockets with projecting heads in F Fig. 19,[2] and the leaf from the Umbelliferae that cluster interposed between the stems of the crockets. On the western f facade of the cathedral of Paris,[3] the sculptur knew how to make the leaf of rumex (20) [4] a grand decoration (21) of incomparable breadth of modeling and purity of form. Sometimes from the flower (for flowers rarely lend themselves to monumental sculpture), they composed the ornament, that has nothing of the flower, unless it be a particular outline, and unusual swelling; but in the corollas, whose forms are almost always undecided, they substitute actual leaves very clearly characterized. Thus (22) from the flower of the snapdragon, different views of which we give at A, they have composed the head of a crocket B,[1] three members of which recall the leaf of t the hepatica (23). From these same flowers of snapdragon while still young, they have made extremely simple leaf crockets D, that are found at the angles of capitals of the beginning of the 13 th century. From that leaf of hepatica, Fig. 23, the artists of that epoch have made great use; sometimes they have superposed these leaves to form the bands of archivolts, c correctly retaining this concave modeling, simple and smooth, but slightly accenting the divisions of the leaf.

Note 1.p.504. A little larger than nature.

Note 2.p.504. From the external cornice of the hall of the synod at Sens; about 1235.

Note 3.p.504. Bond under the great gallery; about 1215.

Note 4.p.504. Natural size.

Note 1.p.506. From the cathedral of Paris! about 1220.

Although the lay school evidently wished to break with the traditions of Romanesque sculpture, one still feels until about 1240 some vague remains of that influence sometimes enter. Perhaps also the art objects brought then from the East to t the West furnished certain ornamental motives, that cannot be derived from the French flora; but these examples are so rare, we may say are so slight, that they only confirm the rule. B Besides, the masters who constructed our edifices of the beginning of the 13 th century were compelled to have recourse to such a great number of sculpturs to realize their conceptions, that they must frequently employ both old and young men; the former were necessarily permeated by Romanesque traditions, and could not abruptly adapt themselves to the new mode, and mixed timidly the remains of the art of their time with the models imposed on them. As proof of the aversion of that school to those old traditions, is that one finds no reminiscences of the past in sculpture, except on certain sacrificed p parts, slightly apparent on the monuments. Where the sculpture was visible, or it occupied an importaut place, on the contrary one recognizes the use of the new flora from the first years of the 13 th century.

The spirit of analysis and research, the rationalism of the lay school rejected Romanesque traditions in the architectural ornamentation as in the construction; at first because those traditions belonged to the ancient religious orders, and that the general reaction occurred against those orders; then because the new school took everything into account, or rather gave to itself reasons for all that it created. That was a s system which was inflexible, like all systems, imperious in its expression, admitted no concession, no digression. It was a radical reform.

If as we have seen at the beginning of this Article, the C Cluniac monks introduced in their sculptured ornamentation s some plants borrowed from the local flora; if perhaps they f first placed the art of the ornamentist in that path, it must indeed be recognized that they adopted a great number of ornaments derived from the Roman decadence, some others taken f

from objects or fabrics furnished by the East. As we have had occasion several times to mention the last fact, it is necessary to give proofs, while remainiug within the subject of t this Article.

We posses in France today, thanks to our gardens and our h hothouses, a great number of plants that came from the depths of the East, and that in the 11 th century were entirely unknown in France. For example, such is that charming plant designated by the name of Dicentra, whose beautiful clusters of flowers assume such elegant forms and so original contours. (24). Dicentra comes from China and India. We do not know if in the 11 th century of our era it was found on the banks of the Tigris and Euphrates; but what is apparent to us is, that the very characteristic form of these flowers is reproduced on the fabrics or the most ancient objects brought from the East through Byzantium. Now we find on the mouldings of the transverse arches and archivolts of the abbey church of Vezelay ornaments, that are merely a badly understood and second hand interpretation of these flowers (25). We could multiply these examples, but it is necessary to limit ourselves. It is very well understood that these ornaments, in the eyes of persons that claim to find for everything a reason and an origin, were only barbaric conceptions due to chance with no signification, and that consequently they should be rejected. Thus the lay school soon fell into the abuse of its system; after having interpreted and arranged the natural flora of the fields to apply it to the severe requirements of monumental sculpture, it comes to scrupulously imitate that flora, at first with reserve by carefully selecting plants, that by their forms best lent themselves to sculpture, theu later by taking the most flexible and slender plants, then even by exaggerating the modeling of those natural productions. This second p phase of Gothic art is more easily made known than the former; it is still full of interest. In more closely approximating to nature, the sculptors of the middle of the 13 th century, fine and scrupulous observers, seized the general characteristics and form of the plants, and reproduced those characters skilfully. They loved the plants, knew their charm, knew how are attached the petioles of the leaves, and how are arranged their fibrous ribs; they retain and reproduce with care those

outlines, so beautiful because they always express a function or are subjected to the needs of the organism; they find in the plants the qualities they seek to accent in the structure of their edifices, something true, practical and reasoned; thus there is perfect harmony between that structure and the ornamentation. This is never a facing or superfluity. The ornamentation of Gothic architecture of the fine epoch is like a natural vegetation of the structure; thus one cannot satisfy taste by adopting a mode of construction of those reasoning architects, then desiring to apply the ornamentation taken from elsewhere or from fancy. (As we have demonstrated elsewhere), Gothic construction is the result of a reasoned and logical system, mouldings are traced because of their purpose; likewise also the ornamentation has its laws like the natural products serving it as types. Those artists go so far as to admit the variety, that is found in the leaves or flowers of the same plant, and they have observed how nature proceeds, and proceed like her. Why and how have we lost those charming faculties inherent in our country? Why have we abandoned those methods of art derived from our Gaulish spirit? Instead of having recourse to true sources, to models that our intelligence supplies to us, our faculty of understanding nature, why have we sought foreign and degenerate arts, to copy without understanding them, then to recopy those copies? We refrain from saying that here, because that subject would carry us too far. (Arts. Gout; Style). Let us simply state, that what is commonly called the caprices of Gothic art, in the structure as well as the ornamentation, are very logical and very refined deductions from a body of doctrines established by a series of true, profound aud correct observations.

A proof that the principle of ornamentation adopted by the great lay school of architecture is fertile, is that each province makes a different application of it by reason of its individual character. In Ile-de-France the servile imitation of plants made itself felt only quite late, about the second half of the 13 th century; for a long time the interpretation of nature and style persisted in the great ornaments, material imitation being only permitted in some details of too little importance to influence the lines of the architecture. M Material imitation appeared earlier in Champagne; it rapidly

to dryness and mannerism. It remains [illegible]
[illegible] when Gothic succeeded; but it [illegible] a charac-
ter of [illegible] and power. It is so [illegible] that it [illegible] its
[illegible] its [illegible]. The architectural flora
of Romanesque until the end of the 12th century possesses a
broad and energetic character, but never falls into imitation;
it is always monumental, although frequently [illegible]-
[illegible] scrupulous [illegible]. [illegible] is it necessary
to go to seek those delicate [illegible] and [illegible] of foliage,
[illegible]
[illegible] the [illegible] of the [illegible] of [illegible],
or the [illegible] of the chancel of the [illegible] of S. [illegible]-
[illegible]-des-Prés: [illegible] the [illegible] of the
middle of the 12th century [illegible] capitals with broad foliage
[illegible] vegetation in stone. [illegible]
[illegible],
like those of columbine (25), chrysanthemum (27) and parsley
(28); [illegible] and flowers [illegible] and [illegible], [illegible]-
[illegible] and [illegible]. They love the [illegible] of
the vine (29), the buds of convolvulus (30), the leaves with
[illegible] of the [illegible] (31). They [illegible]
[illegible], [illegible] by [illegible] of the [illegible]
[illegible], the [illegible], the leaves of mallow, celery, of the
umbellifers, [illegible] with [illegible],
so refined, and [illegible], so [illegible]. [illegible] desire to [illegible]-
foliage [illegible] but [illegible] models, they [illegible]-
[illegible], violet, sorrel, geranium, strawberry, [illegible]-
[illegible] and ivy. For example, [illegible] both sculptors
have utilized the leaves of the chrysanthemum and of parsley.
In the [illegible] portal of the facade of the [illegible] of
[illegible] is seen a beautiful [illegible]
the arch of the 13th century. This archivolt consists of a
series of voussoirs, each bearing in the hollow a large bunch
of leaves [illegible] and cut by the [illegible] of a [illegible].
One of these [illegible], that at [illegible] (32), [illegible]
the leaves of parsley; [illegible], the leaves of the [illegible]-
[illegible].
[illegible]
[illegible] and [illegible], [illegible] to the [illegible]-
[illegible], as [illegible] the same [illegible] in the [illegible] of [illegible]

to dryness and mannerism. In Burgundy imitation makes itself felt when Gothic appeared; but it long retains such a character of grandeur and power, is so living, that it hides its m models under its copious appearance. The architectural flora of Burgundy until the end of the 13 th century possesses a broad and energetic character, that never falls into mannerism; it is always monumental, although frequently reproducing plants with scrupulous accuracy. Not in Burgundy is it necessary to go to seek those delicate friezes and archivolts of foliage, that we see sculptured from 1257 on the south portal and beneath the voussoirs of the red portal of Notre Dame of Paris, or the ancient portal of the chapel of the Virgin of S. Germain-des-Pres;[1] but we also find there in the monuments of the middle of the 13 th century great capitals with broad foliage and high friezes with broadly treated vegetation in stone. B Burgundian sculptors seek plants with leaves strongly divided, like those of columbine (26), chrysanthemum (27) and parsley (28); whose petioles and fibrous ribs and long, properly attached and strongly accented. They love the young shoots of t the vine (29), the buds of convolvulus (30), the leaves with such beautiful character of the scabiosa (31). They disdain t the sweetbrier, often reproduced by sculptors of the 13 th c century, the trefoil, the leaves of mallow, briony, of the U Umbelliferae, celandine with such soft modeling, potentilla so refined, and geranium, so delicate. If they desire to use foliage with simple contours but strongly modeled, they gather aristolochia, violet, sorrel, hepatica, strawberry, plantain and ivy. For example, observe how those bold sculptors have utilized the leaves of the chrysanthemum and of parsley. On the principal portal od the facade of the abbey church of Vezelay is seen a beautiful archivolt built about 1240 around the arch of the 12 th century. This archivolt consists of a series of voussoirs, each bearing in the hollow a large bunch of leaves vigorously recurved and cut by the hand of a master. One of these branches A, that we give here (32), reproduces the leaves of parsley; others at B, the leaves of the chrysanthemum.

Note 1.p.510. Fragments deposited at S. Denis, about 1250.

This ranged and continuous sculpture, subject to the mouldings, we do not find at the same epoch on the monuments of I

Ile-de-France. It is a real vegetation reproduced with an excess of sap. Burgundian blood has pushed the hand of the artist. He takes nature but does not arrange it like his colleagues of the banks of the Seine and Marne, he develops and exaggerates it. Is not this an art which thus permits the artist to impress so strongly his character on his work, while folliwing an accepted principle? Although the sculptors of our t three French lay schools chose the plants that accorded with their temperaments, all scrupulously apply certain laws, that in the eyes of the botanist are not sufficient to indicate t the individuality of the plant, but which for the artist are the true ones; those that observation gives to each imitation of a plant its appearance and proper character. When today we copy a hundredth copy of a leaf of acanthus or angelica, because the Greeks imitated those plants, we can cause our ornamental sculptors to execute a work perfect in execution in marble, stone, stucco or wood, but we cannot give the apparent qualities of life to those imitations by a hundredth hand, th these are only cold decorations that interest no one, cause one to think of nothing else, only that we have caused to be made a capital or a frieze. It is even allowed that to occupy as little as possible the eye of the passer, we repeat the s smae capital ten, twenty or a hundred times, from that identical model. This point being established, that for architecture to be classical it must be wearisome, under pain of being put to the ban of the classical school, we cannot attempt to interest the public by our works. Provided that the carved ornamentation be proper, equal and uniform, everyone must be s satisfied; one does not worry himself to know if those leaves extending on our tympanums, those scrolls developed on a frieze, have some points of relation to plants; whether they are created liveable, if they submit to those laws of the natural flora, admirable because rational. The artists of the 13 th c century, that men desire to believe were left to caprice, have other scruples; they think that ornaments subject to some arrangement should not all be cut in the same mould; that the public will take some pleasure in seeing twenty capitals differing in details; that it would prefer to find around those capitals, on those bands and under those archivolts, the plants of its fields; that to imitate for sake of imitation, it

is better to seek its models in nature, which is always true, frequently beautiful and varied, that to copy Byzantine embroideries or Roman ornaments executed as taskwork by artists c careless of form , according to badly understood traditions; that the local flora being accepted as the starting point of all ornamentation, the types being sufficiently varied, easily found and living, everyone can find innumerable applications of those types, according to his taste and his merit; that in the arts, if it be necessary to establish very rigorous principles, it is necessary to permit all the applications that can be made. So well that those lay artists of the 13 th century, who firmly believed that they opende to the arts an era of liberty and progress, and who in fact did open it, would probably be astonished if they heard today, by those who desire to rivet us to the arts of antiquity and their unreasoned applications, that this art of the 13 th century is superannuated and without new applications.

"Well, who prevents you from using it? They might reply; we have not improved forms, have only brought forward principles, either in construction or ornamentation; it is true that we h have taken the form that seems to us to best accord with those principles and our taste; but who forbids you to take others or to modify these that we have adopted? Do you believe that you are original because you imitate a capital of Mars the Avenger, or a house of Pompeii, an arabesque of the Renaissance, a cartouche of the 17 th century, or a frieze of the boudoir of Madame de Pompadour? Do you not think that there will be more chances of inventing new forms by collecting in the forests some of those plants on which you walk indifferently; by analyzing those plants as we do ourselves; by examining t the angles of their petioles, the causes of their leaves, the attachments of their shoots? Who requires you to copy our capitals? Seek the same models as we do, try to understand them better than we do, which will not be difficult, since you are wiser and the entire earth brings its plants to our conservatories. Must we copy each other reciprocally? Did not our artists have recourse constantly to those natural sources? There are perhaps a million capitals of our time in France, but you will not find two identically similar; it is the same for all our sculptured ornamentation. We have represented thous-

thousands of times the leaves of the vine, fig, ivy, geranium, maple, pomegranate, violet and fern; but to make a maple leaf, we do not copy the sculpture of our neighbors, but go to walk in the thickets; hence the maple leaves carved on the edifices that we have erected are as varied as are those that grow in the forests. Further, with those fragments of plants we compose and invent new combinations; why not do as we have done, and how will this method cause you to retrograde? -- To retrograde is your greatest fear. -- Very well; for that do you re reject the sole art, that allows one to advance because of t the breadth and liberality of its principles? And to mention only the scluptured ornamentation, do you think to open new paths by copying a flower chiseled by Etruscans, by poorly r reproducing some beautiful capital of the time of Augustus, or by imitating the debased sculpture of the end of the last (18 th) century? Still you state that it is more conformable to unchanging taste to copy the Romans or the heavy caprices of the age of Louis XIV, while the fields continue to be covered each spring by their charming verdure, the trees always shoot forth, the flowers do not cease to bloom; why then do you not draw from that inexhaustible treasury? This is why we desire to foud an art method always young and living, that we draw from it ourselves. Are plants less varied, have they less grace and flexibility than in our time?"

What could one reply to those artists, who speak in their works, our predecessors by six centuries, but more youthful t than we are, and especially more friends of progress?

What one cannot study too much in the application as made by those artists of the flora to sculptured oruamentation, is the exact observation of the principal characteristics of the form. They neglect or suppress the details; but what they express with the care of passionate lovers of nature are the gr grand lines, those that characterize each plant, as for example, the angles formed by the fibrous ribs of leaves, the appearance of the petioles, the beautiful lines given by the edges of those leaves, the character of their serrations, the projecting profiles of the modeling, the energetic swelling at the junctions. Let us analyze this, for on this subject th that appears to us important, should be left no uncertainty in the minds of our readers. For example, the leaves are only

flexible in one sense, they can be bent in the direction of t their thickness; but because of the fibrous tissue that forms a stay between their edges, they cannot be bent edgewise. Thus (33) a maple leaf A can be bent as indicated by the sketch B, but one cannot give it as iu sketch G without destroying or crumpliug its tissue and altering its form. Yet we see that since the Renaissance, when the study of these natural productions was replaced by imitations of intique sculpture more a and more corrupted, our sculptors of ornament have infringed that principal law. On the contrary, its observation leaves to monumental sculpture a firmness and necessary life. If G Greek artists have to make a frieze or a garland of leaves; by placing the leaves in all directions according to the requirements of ornamentation, they take care to preserve for e each leaf the immobility, that it must necessarily retain in the direction edgewise. To obtain variety iu the modeling, t they sometimes present the back of these leaves, sometimes the front, as shown in Fig. 34.[1] They note that the fibrous ribs necessarily impose thi form of the tissue, just as the bones of animals determine the form of the muscles. Then they direct all their attention to the fibrous ribs, so that being obliged to suppress certain details to give the sculpture the monumental appearance which it must retain, they can always retain the appearance of the plant. Thus for example, from the fig leaf they omit many of the serrations, quite soft in form and that weight the leaf, but (36) [2] they retain accurately the angles of the fibrous ribs; they exaggerate the character of the principal iudents; they seize all the dominant points, the beautiful lines of those indents; they give to the quite flat modeling of that leaf great energy, while still respecting its curves.

Note 1.p.517. From the rood screen of the cathedral of Chartres; fragments ., about 1245.

Note 2.p.517. From Notre Dame of Paris; south portal, 1257.

But if we cast our eyes on Fig. 35, we see that in the leaf of the Fig., as in most leaves, the outlines are contrasted, yet retaining at each side of the fibrous branches portions of tissues, that present a certain symmetry. Thus opposite t the depressions A are found the expansions B. The same observation can be made concerniug the muscular contours of animals.

The sculptures of the middle zone have therein followed the [illegible] in all cases [illegible] did not commit a rigorous balancing of the two sides, as for the middle parts. Fig. 75, that shows as now the sculptors have interpreted the leaf of the fig, only gives two borders absolutely balanced on the central member of the leaf; as for the six other members, they are carved according to the natural principle. Their imitation of the flora is thus perfectly intelligent; the artist knows how to make the conditions necessary; from the plant he chooses a form [illegible] that belongs to him, although he retains and even accentuates the distinctive characters, qualities and charms of the natural object. The sculptured leaf that we give here has an appearance much more characterized than the leaf of the tree. It is more the leaf of the fig tree than the real one, from the point of view of art, if not of [illegible].

It is rare that the sculptors of the [illegible] century have [illegible] leaves as large in scale as this; usually, as we have often seen, they seek their compositions in smaller plants, because these present simpler forms, more [illegible] outlines and more [illegible]. One can see by the examples already given, what use the ornamentists made of plants, that scarcely rise above the ground. What seems to have [illegible] chosen by these artists is, first the beautiful arrangement of the [illegible] ribs; then the [illegible] and contours given by the [illegible] of the leaves. When the contours are [illegible] and [illegible], [illegible], [illegible], [illegible] the leaves [illegible], is more beautiful and [illegible] of the [illegible].

Fern (77) is a very common fern, drawn a little lower than nature. Is there anything more energetic in appearance of lines and [illegible] than this little plant? [illegible] observe the beautiful curves of the petioles, the delicacy and firmness of the [illegible], and he will comprehend that a sculptor can make great use of this model; hence he did not fail to be inspired by it in the ornaments of the [illegible] and even the [illegible] centuries. [illegible] delicate extremities of the ends of the leaves [illegible] frequently served as the types of [illegible] and [illegible] (77).

The sculptures of the middle ages have therein followed the natural rules in all cases in which the needs of ornamentation did not compel a rigorous balancing of the two edges, as in t the middle parts. Fig. 36, that shows us how the sculptors have interpreted the leaf of the fig, only gives two borders absolutely balanced on the cenaral member of the leaf; as for the six other members, they are curved according to the natural principle. Their imitation of the flora is thus perfectly intelligent; the artist knows how to make the sacrifices necessary; from the plant he produces a work of art that belongs to him, although he retains and even emphasizes the distinctive characters, qualities and charms of the natural object. The sculptured leaf that we give here has an appearance much more characterized than the leaf of the tree. It is more the leaf of the fig tree than the real one (from the point of view of art, if not of science).

It is rare that the sculpturs of the 13 th century take as leaves as large in scale as this; usually, as we have already seen, they seek their inspirations in smaller plants, because these possess simpler forms, more energetic outlines and more powerful modeling. One can see by the examples already given, what use the ornamentist can make of plants, that scarcely r rise above the ground. What seems to have determined choice by those artists is, first the beautiful arrangement of the petioles and fibrous ribs; then the angles and contours given by the tissues of the leaves. When the contours are soft and do not clearly accent the anatomy, oppose the direction of t the fibrous ribs, which occurs sometimes, they reject the leaf. Thus the leaves whose anatomy is most beautiful and clearest are those of the smallest plants.

Here (37) is a very common fern, drawn a little larger than nature. Is there anything more energetic in arrangement of lines and recief than this little plant? Let one observe the b beautiful curves of the petioles, the delicacy aud firmness of the junctions, and he will comprehend that a sculptor can make great use of this model; hence he did not fail to be iuspired by it in the ornaments of the 13 th and even the 14 th centuries. These delicate serrations of the ends of the leaves have frequently served as the means of decorating great oruaments, and which was given a delicate and precious appearance.(38)[1].

Note 1.p.520. Capital from nave of Notre Dame of Paris; triforium, about 1205.

The artists of the 15 th century only sought examples among plants with strong relief; they chose black hellebore, chrysanthemums, sage, pomegranate, strawberry, mallow, geraniums, ferns with broad leaves, oak, maple, passion flower, ivy and vine, and they copied the leaves of these plants with rare p perfection, frequently exaggerating their modeling or contours. They abandoned those buds and seeds with which the artists of the end of the 12 th century had known how to compose s such beautiful ornaments. Not only did they choose leaves at their full development, but they loved to crumple them; what they desired was to produce effect, and on the whole, their ornaments became confused and mean by the lack of simplicity in contours and relief. From the leaf of the vine, where the relief is broad and arranged in great planes, they found means to compose ornament (39).[1] They loved undulating lines, leaves folded and rumpled; they gather that great fern that grows on the surfaces of damp walls (40); they observe those capsules or sporangias A placed on the lower surface of the leaves, a and that form bosses on their external surface, and also exaggerating the folds of the leafy appendages, they obtain ornaments with crumpled outlines, coarse relief, whose appearance is attractive near, but at a distance only presents more than one series of recessions of lights and shadows very difficult to comprehend.(41).[2]

Note 1.p.521. From the tomb of bishop Pierre de Roquefort. S. Nazaire of Carcassonne; about 1325.

Note 2.p.521. From the abbey church of Eu.

About the beginning of the 15 th century, the imitation of plants fell absolutely into realism. Sculpturs then chose the most dissected leaves, passion flower, thistle, thorn, wormwood (42); and from the last plant, so small that it is scarcely perceived on the stony ground on which it grows, they composed great and wide friezes, bands, energetic crockets, but with altered leaves in excess. Yet one conceives that with these leaves, whose lines are beautiful, can be made grand o ornaments; this was also the remnant of the traditions of the lay school of the 13 th century, which sought its models for ornaments among the smallest creations of the plant order. The

The masters of the 15 th century were loved to introduce a [illegible] of this style with very great [illegible] (Greco, [illegible], Ghiberti).

At the end of the 15 th century French artists had attained the last limits of the possible in the art of construction; as for ornamentation, they had even gone as far as they could in the imitation of the most delicate plants, the more difficult to render in stone or wood; the [illegible] made us [illegible] that products of sculpture under excessive realism. [illegible] from 1480 to 1515, the [illegible] of the French school of sculptors prolongs its traditions with the [illegible] of [illegible]; and it is easy to recognize that [illegible] from natural sources, that used no longer consult the flora, and that their ornaments are nothing [illegible] more or less skilfully executed. They copy or rather interpret [illegible] from actually [illegible]; or [illegible] with the [illegible] of [illegible] etc., they still continue [illegible], the taste for sculpture was then alive among us, while the executors were skilful with their hands. But through this confusion of active and o[illegible], the artist was difficulty in following the course of an art which [illegible] as a [illegible] school. [illegible] have [illegible] the [illegible] of that school. However, [illegible] the [illegible] is [illegible], and the art of sculpture [illegible] at the end of the 15 th century is no more than a pale reflection of what it [illegible] the study of [illegible] to the [illegible] of the [illegible]; the difference [illegible] that living and [illegible] character, that only [illegible] a [illegible] seeking to reproduce [illegible] forms, [illegible]. About the beginning of the 17 th century, the ornamentation improves in effect by reason of a more careful study of [illegible]; the [illegible] and [illegible] is looked [illegible] in [illegible] art, [illegible] and [illegible].

[illegible]. Foundation. [illegible].

The [illegible] of the [illegible] their edifices on a [illegible] soil by means of [illegible] layers of concrete, that formed [illegible] and solid footings under the [illegible], [illegible]-

The artists of the 15 th century also loved to imitate the f fresh or salt algae with very strong relief.(Arts. Fleuron; Sculpture).

At the end of the 15 th century Gothic artists had attained the last limit of the possible in the art of construction; as for ornamentation, they had even gone as far as they could in the imitation of the most delicate plants, the most difficult to render in stone or wood; the Renaissance came to arrest that progress of sculpture toward excessive realism. During several years from 1480 to 1510, one sees the French school of sculpture mingle its traditions with reminiscencer of antiquity; but it is easy to recognize that artists no longer draw from natural sources, that they no longer consult the flora, and that their ornaments are nothing more than patterns more or less skilfully executed. They copy or rather interpret ornaments borrowed from antiquity without understanding them; by combining these imitations with the last vestiges of Gothic art, they still produce remarkable works, the taste for sculpure was then alive among us, while the executors were skilful with their hands. But through this confusion of styles and o origins, one indeed has difficulty in following the course of an art; it is a movement impressed by a powerful school, that continues long after the disappearance of that school. However, gradually the execution is enervated, and the art of sculpture and ornament at the end of the 16 th century is no more than a pale reflection of what it still was in France under the reign of Louis XII; the study of nature enters nowise into the composition nor the work of the artist; the ornaments lose that living and original character, that they possessed a century earlier to reproduce gradually types, that daily de-degenerate. About the beginning of the 17 th centurw, the ornamentation improves somewhat by reason of a more careful study of antiquity; but originality and sap is lacking thenceforth in that art, which our old lay school had known how to elevate so high.

FONDATION. Foundation. Footings.

The Romans of the empire always founded their edifices on a resistant soil by means of great layers of concrete, that formed homogeneous and solid footings under the structures, com-

composed of fragments of stone, pebbles, sometimes of pieces of terra cotta, with excellent mortar. Roman foundations are real artificial rocks on which could be placed the heaviest structures, without fearing ruptures and settlements. Besides, Roman construction being of concrete without elasticity, it was necessary to establish it on immovable bases. During the Romanesque period, edifices are generally badly founded, due to several causes; men knew little of the nature of soils, co considerable accumulations of materials were difficult, and they no longer knew how to burn and properly employ lime. We have explained elsewhere (Arts. Carriere, Construction) the reasons opposed to the Romanesque constructors for collecting much material in a brief time, and why without the resources at the command of the Romans, they often neglected the foundations of the most important buildings.

The lay architects of the school of the 12 th century had seen so many Romanesque structures fall, by defects in foundations or because of the thrust of vaults badly abutted, that they desired to avoid these disasters; for that purpose they took particular care to establish durable foundations, and to render their structures sufficiently elastic that settlements were no longer to be feared. But however skilful we assume an architect, it is necessary to supply him with the material m means of construction; now in the erection of the great cathedrals and many churches, the enthusiasm and zeal of the bishops do not always correspond to the extent of their financial resources; then the secular clergy especially desired to make its influence appear; it acted for itself to lessen the influence of the monasteries, to draw the faithful to itself; in many cases then with means relatively insufficient, men desired to erect religious edifices, that could surpass in extent and richness the churches of the Benedictine monks. This explains why some of our great cathedrals, like those of Troyes, Chalons-sur-Marne, Seez, Meaux, are badly founded. It was necessary to erect rapidly sumptuous edifices of beautiful appearance, and the resources being relatively moderate, men were unwilling to bury them in the ground in great part. Other cathedrals erected in the midst of rich dioceses, like those of Paris, Rheims, Amiens and Bourges, on the contrahy are founded with extraordinary luxury of materials. As for the castles,

military and civil structures, that are always still lasting. The lay lords and the ecclesiastics preferred aqueducts that [illegible] not desired durable foundations, because the lord of the castle built to protect himself and his family in perpetuity, and the castles built for a long series of generations.

The foundations of the Romanesque castles are always made of great masses cast well into the bed of rock; they are rarely [illegible]. The foundations of [illegible] structures, on the contrary, are faced with [illegible] of cut stone [illegible] in [illegible] and properly [illegible] the [illegible] are laid with rubble set in good mortar. ([illegible]), [illegible] with [illegible] and [illegible] within. [illegible] in [illegible] on this subject, [illegible] consequences [illegible] same [illegible] as [illegible]; [illegible] the soil formerly [illegible], [illegible] and [illegible] by water, they [illegible] to [illegible] in it. [illegible] by water, [illegible], [illegible] to [illegible] in [illegible] that [illegible] they [illegible] the [illegible] of the foundations. [illegible] to connect [illegible] all the walls and [illegible] in the foundation; i.e., for example, [illegible] of [illegible] walls and of [illegible], they formed a [illegible] of [illegible] underground, so [illegible] of the [illegible]. [illegible] always [illegible] with [illegible] of [illegible] the principal [illegible] of support, and [illegible] 13 [illegible] [illegible].

[illegible]

[illegible], [illegible] have [illegible] proportions of [illegible] of the [illegible]. [illegible], or [illegible] they took [illegible] of [illegible]; they [illegible] of the [illegible] of the [illegible] the [illegible] they [illegible], if necessary, to [illegible] pure [illegible], and they [illegible] from no labor or expense to bring considerable volumes of water into the [illegible] of [illegible]. [illegible] of [illegible] there, these [illegible] suffice however to supply the [illegible] on [illegible]

military and civil structures, they are always well founded; the lay lords and the municipalities regarded appearance less but desired durable structures, because the lord of the castle built to protect himself and his family in perpetuity, and the cities built for a long series of generations.

The foundations of the Romanesque period are always made of great masses cast pell mell into the bed of mortar; they are rarely faced. The foundations of Gothic structures, on the c contrary, are faced with surfaces of cut stone ashlars set in regular courses and properly shaped; the masses are laid with rubble set in good mortar. (When the resources are not wanting), these foundations have wide footings and rest on resistant s soils. Yet it must be stated on this subject, that the Gothic constructors had not the same scruples as we have; when they found the soil formerly filled, well compressed and settled by water, they did not hesitate to found on it. Old silt and mud deposited by water, fillings long percolated, appeared to them to be sufficient soils; but also in that case they gave a broad bearing to the base of the foundations. They never failed to connect together all the walls and masses in the foundations; i.e., for example, beneath an edifice composed of wa walls and of isolated piers, they formed a grillage of masonry underground, so as to make all parts of the foundations st stable. During the 14 th and 15 th centuries foundations are always established with extreme care on virgin soil under the principal points of support, and numerous connecting walls. It even frequently occurs then that the surfaces of foundations are as well dressed as those in elevation. (Art. Construction).

FONTAINE. Fountain.

At all epochs, fountains have been regarded as monuments of public utility of the first order. When the Romans established a city, or when they took possession of ancient cities, they thought of the management of the water supply before all else. They went afar, if necessary, to seek abundant and pure sources, and they recoiled from no labor or expense to bring considerable volumes of water into the centres of population. At Rome, although four fifths of the ancient aqueducts are destroyed, those remaining suffice however to supply the modern ci city with a greater quantitw of water, than that furnished to

the city of Paris with five times the population. At Nimes, L Lyons, Frejus, Arles, Autun, even at Paris, we still find traces of Roman aqueducts bringing water from very far and at high levels, in order to secure easy distribution by means of great reservoirs. Everywhere in France that is found an abundant and sanitary source, one is almost certain to discover the ruins of Roman constructions. The Romans attached major importance to urban sanitation; there is no sanitation without a good c city government, and there can be no good government without water. In that respect we have something to do; many of our great cities still lack water today; then one should not be surprised, if during the middle ages fountains were not very common in the midst of cities. Among the Romans, water was a true ornament of all fountains; men had not yet thought of e erecting fountains in which water would be an accessory more inconvenient than useful. The few fountains of the middle ages that we have been able to collect have not that monumental appearance, and do not present that mass of stone, marble and bronze, that one believes himself obliged to accumulate in o our days to accompany the thread of water. Still (and that is probably derived from the traditions of antiquity) water seems a thing so precious, that it is only given to the public when surrounded by what can emphasize its value; it is economized and placed within reach of all, but with more respect than v vanity. The fountain of the middle ages is then a monument of utility and not of decoration, a pretext for representing allegories in marble and metal, more or less ingenious, but which all have the great defect of being ridiculous for men with a moderate belief in mythology, bearded rivers and naiads crowned with roses. The fountain that imprints a vivid trace in the memory, is that found at the side of a dusty road, allowing its basin of limpid water to be seen beneath a shelter, i its copper cup attahed to a chain, and a modest inscription recalling the name of the founder. Without always being as h humble, the fountain of the middle ages retains something of the simplicity of this programme; it does not deafen or splash, but it invites the passer to approach it. It is not necessary to receive a shower to quench thirst.

The fountain of the middle ages is a little covered basin f from which one can draw by descending some steps, or a column

or pier surrounded by the large basin and with a more or less great number of pipes distributing the water to all comers. The basins surrounded by steps were reserved in gardens and orchards. In the stories and tales of the 12 th and 13 th centuries is frequently mentioned this sort of fountains,[1] and without leaving the domain of reality, we still see in Poitou, Normandy, Brittany, and Burgundy, quite a large number of fountains placed at the edges of the roads for the needs of the traveler. The spring is ordinarily covered by a masonry arch, the basin extending toward the road as if to invite one to d drink there; benches allow one to rest at the side; a niche i is arranged at the rear of the vault that receives the statue of the Virgin or of a saint; the arms of the founder decorate the tympanum of the arch or the wall of the fountain (1). Outside the suburb of Poitiers, beside the Clain, is to still be seen a fountain of that kind, restored in 1579, but whose construction dates in the 14 th centurw. It turns its back to t the street, and one reaches its basin by means of a flight of steps at one side of the little structure. The arms of the gigiver are placed so as to be recognized from the road and from that flight. The arrangement of those fountains is evidently very ancient; one recognizes in them a trace of Roman antiquity. A little building protects the spring and receives the d deity that is its dispenser, an inscription giving the name of the founder for public recognition, benches for resting, is not that an antique programme? But this sort of fountains is only suited to the countrw; in the cities, on places or crossings, it is necessary for the basin to be accessible to a great number of persons at a time. It is essential for one to obtain water, not in the basin stirred by the movement of persons carrying off water, but at the source itself distributed in a certain number of channels.

Note 1.p.527. See Lai de Narcisse, Lai de l'Oiselet, Paradis d'Amour; in the last tale the author describes a fountain concealed in a garden. He says that one descended to it by marble steps, to which was attached a cup of enameled gold by a silver chain.

Thus was arranged the fountain of the 12 th century that one still sees at Provins opposite the hospital (2). A hexagonal basin, a great column whose capital is pierced by three holes,

fitted with bronze heads projecting sufficiently to pour the water into vessels set on the border of the basin, such is this little monument in its primitive simplicity. Perhaps formerly this capital was surmounted by a statue or a pinnacle, like certain fountains seen represented in paintings and manuscripts of the 14 th century. At A is traced the plan of the fountain of Provins, at B is given the detail of one of the bronze pipes.

Some cities of Italy, Perugia, Viterbo, Siena, have retained their fountains of the end of the 13 th century and beginning of the 14 th. In France we possessed at that epoch very beautiful urban fountains; but we destroyed them long since; it is rarely by chance that one discovers some fragments of those monuments due to the generosity of sovereigns or of r rich lords. They were composed in nearly the same manner, i.e., they consisted of a lower basin raised by two or three steps above the ground (2.0 to 3.9 ft.), a very deep basin made to collect the water from the spouts, to place and wash the vessels, the basin in which one cannot drink; the central pillar receiving long distributing pipes extending nearly to the border of the lower basin, allowing pitchers to be filled. The central pilla was more or less decorated, sometimes bearing an upper basin allowing little jets to escape only for pleasure. There was on place of Notre Dame at Paris a very beautiful fountain of this kind, that was replaced in the 17 th century by a very heavy monument; one sees one yet, though mutilated and changed, on the place of the city of S. Florentin. At Brioude exist very pretty fountains of the 13 th century, most of whose details have been modified. The cities on the banks of the Rhine and in Germany also possess some monumental fountains of a quite recent epoch (15 th and 16 th centuries), although drawn according to the old programmes.

We give (3) one of those fountains of the 13 th century in plan, and (4) in perspective. The plan (Fig. 3) indicates at A the horizontal section of the monument the lower basin; at B the section above that basin, and at C the section of the u upper pier supporting the statue, with the projection of the two superposed basins. Those fountains were supplied by means of subterranean aqueducts, as we have frequently had occasion to state. Those aqueducts were usually of masonry, lined inside

by good cement according to the Roman method; iron [illegible]
of lead; but we have found fragments of them at Carcassonne,
Clermont (Auvergne), and in the vicinity of ancient abbeys, at
S. Denis near Paris and Clairvaux. Near Carcassonne are still s[een]
the remains of an aqueduct that appears to [illegible] from the
[illegible], and that is borne on a pointed arcade crossing
across the valley northwest of that city. [illegible], in his
[illegible] de Paris, states that the aqueducts of
the [illegible] and [illegible] from [illegible] to [illegible] rather
than the [illegible] of [illegible] the [illegible]
construction of great aqueducts and canals, built walls of ma-
sonry of cut stone, have often shown [illegible]
[illegible] (as they were covered [illegible] very large stones),
cross conduits being [illegible] ft. or more in length, [illegible]
[illegible] except by [illegible], and 6 ft. in [illegible]
[illegible] by 3 ft. in [illegible], [illegible] could easily walk
[illegible]; [illegible] are accompanied by [illegible]
[illegible] of the [illegible]
[illegible]; at the [illegible] of which is a form of [illegible], [illegible]
[illegible] a [illegible]
[illegible] from the [illegible], [illegible]
[illegible]-[illegible], on the [illegible] of the [illegible]
[illegible] on account of [illegible], at the [illegible] of which is
a [illegible] to receive the [illegible]
[illegible] places. The [illegible] is [illegible]
[illegible], [illegible]
[illegible]; [illegible]
[illegible] and [illegible] were [illegible] in the [illegible]
[illegible], about [illegible] ft. in [illegible], the [illegible] of the [illegible]
of [illegible] very [illegible]." [illegible] was of
Roman origin or was built in the [illegible] of the [illegible]
[illegible], it was always [illegible], and was still [illegible] in the [illegible]
[illegible] century.

It is principally in the monasteries that are found the most
[illegible] and best [illegible] of [illegible] works. All [illegible]
[illegible] at the [illegible] of the [illegible] or [illegible] one
of the [illegible] beautiful basins of stone or marble, [illegible]
[illegible], the water in a [illegible] of jets, [illegible]
[illegible] to [illegible] their [illegible]. ([illegible]). These
[illegible] nearly all [illegible] the same form until the end of the

by good cement according to the Roman method; pipes were rarely of lead; yet we have found fragments of them at Carcassonne, Clermont (Auvergne), and in the vicinity of ancient abbeys, at S. Denis near Paris and Clairvaux. Near Coutances are still s seen the remains of an aqueduct that appears to date from the 14 th century, and that is borne on a pointed arcade extending across the valley northwest of that city. Du Breuil, in his Theatre des Antiquiter de Paris, states that the provosts of the merchants and sheriffs had "from antiquity to bring water from the sources to the fountains of the city, to cause the construction of great aqueducts and canals, build walls of ma masonry of cut stone, pave with stone also the great gutters and basins (as they also covered these with very large stones), those aqueducts being 3200 ft. or more in length, without there being any light except by carrying fire, and 6 ft. in height by 3 ft. in width, along which persons could easily walk with a light in hand; which aqueducts are accompanied by basins or receptacles to agatate and purify the water of the said springs; at the entrance of which is a form of structure, where there is a great receptacle serving as an emissary to receive the water descending from the sandy mountain, called mountain of Belle-Ville-sur-Sablon, on the top of the said aqueduct being an opening of round form, at the middle of which is a sort of well to receive the fine springs descending into it at three different places. The edifice is vaulted in domed f form, with its opening for an open lantern; in that are two stairs of similar round corm; edifice artistic and curiously built; which gutters and basins were rebuilt anew in the year 1457, about 505 ft. in length, the rest of the said aqueducts or channels being very ancient." Whether this aqueduct was of Roman origin or was built in the first centuries of the middle ages, it was always used, and was still maintained in the 15 th century.

It is principally in the monasteries that are found the most numerous and best preserved traces of hydraulic works. All cl- cloisters possessed at the centre of the court or beside one of the porticos beautiful basins of stone or marble, around which pipes distributed the water in a number of jets, permitting the monks to make their ablutions. (Art. Lavabo). These fountains nearly all assume the same form until the end of the

14 th century. In the 15 th century, the column or group of columns placed at the centre of the circular , polygonal or l lobed basin, is often replaced by a pinnacle decorated by sculptures.

Such is a fountain (5) that we see represented in a manuscript of that epoch. [1] At Rouen still exists a very pretty monument of this kind that dates from the middle of the 15 th c century.[2] When Gothic fountains were placed against a civil s structure, they only consist of a little basin and channel p placed in a recess made in the wall itself; however modest were our hydrants, they were only made to satisfy the daily needs of the inhabitants. The middle ages saw no inconvenience in putting a little art into its most ordinary works; today if we carry to exaggeration the richness and luxury of the ornamental monuments of our cities, we compensate for that fault, if it be one, by the poverty and vulgarity of the most useful objects, such as our hydrants, candelabras, and lamp posts.

Note 1.p.533. Poems of Williom de Mochout. Mss. of M. Guillebon.

Note 2.p.533. Fountoin colled de lo Pucelle.

FONTS BAPTISMAUX. Baptismal Fonts.

A basin intended to contain the water for beptisms. There is ~~no~~ reason to suppose that in the first times of the Church, baptism was given by sprinkling, since the apostles baptized kingdoms and entire provinces, thousands of persons in a day.[3] Baptism was then made in a basin, then by immersion. The Arians plunged the candidate three times in the water to mark that there were three natures as well as three persons in God. S. Gregory the Great counselled S. Leander, bishop of Seville,[5] to practise only immersion. The fourth council of Toledo in 1633 decided likewise, and recalling the letter of S. Gregory, it declared that a single immersion signifies the death and resurrection of Jesus Christ, and the unity of the divine nature in the trinity of persons.[6] Without entering into more ample details on this subject, we shall content ourselves by stating that during the course of the middle ages in the West, baptism by immersion was always practised. The reliefs, paintings of manuscripts and stained glass show us candidates b baptized by immersion. "Formerly," says Thiers,[7] "in the province of Rheims, and also perhaps elsewhere, after the baptism

wine was given to the infant to drink, saying these words to it. May the body and blood of our Lord Jesus Christ guard thee in life eternal. It was still the custom in Perigord to bless the wine after baptism and to cause the newly baptized infant to drink of it. The ritual of Perigueux of 1536 gives us that entire ceremony." This author adds later:- "Since a little more that a century (i.e., since the beginning of the 17 th century) the custom was introduced in many parishes, and particularly in the country, to ring the bells after the baptism of infants. In my opinion, the bell-ringers, sacristans, sextons and beadles, introduced it in consideration of their financial gain. The provincial council of Rheims in 1583 did not authorize that custom.

Note 3.p.533. S. Luke. Acts, Chapter 2 and 4.

Note 4.p. 533. Arcudius. De Sacram. LI.

Note 5.p.533. The same. LIII. Letter 41.

Note 6.p.533. The same. Chapter VI.

Note 7.p.533. Des Superstitions. Vol. II. chap. 12.

Until the 9 th century, it appears that they baptized solemnly only on the days of Easter and Pentecost; at least that c custom seems to have been established after the 5 th century, for it is certain that in the first centuries of Christianity the apostles baptized without observing either days or times.[1] Clovis was baptized on Christmas day.[2] Pope S. Leon, who arose strongly against the custom of baptizing at any other time than the day of the resurrection, however admits that baptism can be given in extreme cases on other than the consecrated day.

Note 1.p.534. Latin Note. See William Durand, translation e edited by M. Barthelemy. Notes. Vol. IV. p. 430 et seq.

Note 2.p.534. Letter of S. Avitus, bishop of Vienne to Clovis.

The solemnity given to the sacrament of baptism explains, w why there was a baptistery in the vicinity of the oldest churches; i.e., an edifice sufficiently large to contain a certain number of candidates coming the same day to receive baptism. These edifices were usually circular, the centre being occupied by a shallow basin into which were caused to descend the persons baptized by immersion.[3]

Note 3.p.534. There exists a baptistery beside the basilica of S. John Lateran at Rome; one has recently been discovered near the old cathedral of Marseilles, from the 5 th century.

Those of the cathedral of Aix in Provence and of Frejus are still to be seen. The edifice placed under the name of S. John at Poitiers seems to have served as a baptistery during the 5 th and 6 th centuries.

The custom of baptizing infants soon after their birth at all times prevailed over the opposition of S. Leon and the councils of Toledo, Auxerre, Paris and Gironne; from the 11 t th century we see that baptismal fonts were placed in all churches, not in special edifices, and that baptism was given by priests outside the festivals of Easter, Pentecost or Christmas. It is just the dates of those oldest baptismal fonts, that leads us to believe that then (in the 11 th century), t this custom was definitely introduced in France. Since it was no longer necessary to baptize converted pagans, but newborn infants, these fonts are of small dimensions, and differ from those made today only in their form. Indeed, there is no need of a very large font to immerse a newborn infant. In memory of the baptisteries, i.e., of the edifices only intended to contain the baptismal font, one notes that fonts placed in churches were generally covered by a little structure (1).[1] Sometimes these fonts were antique basins, taken from Roman monuments. Du Breuil [2] claims that the basin of red porphyry to be seen in his time in the abbey church of S. Denis behind the shrines of the martyrs, and that had been taken by Dagobert from the church of S. Hilaire of Poitiers, served as a baptismal font. We do not have to occupy ourselves with baptisteries or the basins that they enclosed, since those monuments precede the art period that we are studying; baptismal fonts alone must find a place here. Many of those basins, from the epoch when they were in use, were of metal, consisting of a large bowl e enclosed and supported in a circle or frame supported by little columns. This arrangement seems to have been followed frequently, even when the fonts were cut in a block of stone.

Note 1.p.535. Ivory of the 11 th century. Collection of the author.

Note 2.p.535. Le Thretre des Antiq. de Paris. 1622. Book IV. p. 1103.

Thus one sees in church S. Pierre at Montdidier a baptismal font of the end of the 11 th century, that presents this arrangement. (2). In the crypt of Notre Dame of Chartres there

still exists a font of stone, cut so as to represent a basin inscribed in a frame supported on little columns. That tradition still persists during the 11 th century as proven by fig. 4, copied from the font of the church of Ver (Calvados).[1]

Note 1.p.138. We owe these drawings to the courtesy of M. Duthoit of Amiens.

Frequently the baptismal fonts of the 12 th century are of rectangular form, probably to entirely immerse the infant that is baptized. There exists the baptismal font of that form and of that size in the cathedral of Amiens; it is a large rectangle about 2.3 ft. wide by about 4.2 ft. long with a depth of 1.64 ft. It is very simple; at the four angles only are sculptured the figures of the four evangelists, in high relief and of small dimensions. The fact that support it date from the 12 th century.

We give (A) a small font of this kind, that comes from the church of [illegible]. It dates from the 11 th century. The canton of Lizy near Nantes possesses baptismal fonts of the beginning of the 12 th century, whose form also approaches that, but which are quite richly sculptured. This font, reproduced in the work of M. Gailhabaud,[1] is of oval form inside, an elongated dodecagon externally; two of the sides parallel to the main axis present slight projections intended to connect between the angles of the prism, which at that point would have been too [illegible]. A beautiful band of leaves ornaments the upper edge; the intermediate portion is occupied by 12 rosettes among which are sculptured a Paschal Lamb, a cross and an ox's head. The base is recessed and presents a series of small arches. The paving around these fonts presents a very remarkable peculiarity; there are 8 slabs of gray stone placed on the surface of the slabs, and that seem to mark the places of persons, that would surround the font at the moment of the baptism. A brace was placed at the edge of the font to receive a spoon; these are indeed baptismal fonts according to the canons of the councils, that must be covered from a very ancient epoch, as they still are today.

Note 1.p.139. L'Architecture et les arts qui en dependent.IV.

The baptismal fonts of the parish church of the city of [illegible] [illegible]; not in a block of stone, they assume the form of a [illegible] oval inside, and are decorated externally

still exists a font of stone, cut so as to represent a basin inscribed in a frame supported by little columns. That tradition still persists during the 13 th century as proved by Fig. 3, copied from the font of the church of Ver (Picardy).[1]

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Frequently the baptismal fonts of the 12 th century are of rectangular form, probably to entirely immerse the infant that is baptized. There exists the baptismal font of that form and of that time in the cathedral of Amiens; it is a large triangle about 2.0 ft. wide by about 5.2 ft. long with a depth of 1.64 ft. It is very simple; at the four angles only are sculptured the figures of the four evangelists, in high relief and of small dimensions. The feet that support it date from the 13 th century.

We give (4) a small font of this kind, that comes from the church of Thouveil. It dates from the 11 th century. The church of Limay near Mantes possesses baptismal fonts of the beginning of the 13 th century, whose form also approaches that, but which are quite richly sculptured. This font, reproduced in the work of M. Gailhabaud,[1] is of oval form inside, an elongated dodecagon externally; two of the sides parallel to t the main axis present slight projections reserved to better detach the angles of the prism, which at that point would h have been too soft. A beautiful band of leaves ornaments the upper edge; the intermediate portion is occupied by 12 rosettes among which are sculptured a paschal lamb, a cross and an ox's head. The base is recessed and presents a series of small arches. The paving around those fonts presents a very remarkable peculiarity; there are 8 disks of gray stone placed on the surface of the slabs, and that seem to mark the places of persons, that should surround the font at the moment of the baptism. A hinge was placed at the edge of the font to receive a cover; these are indeed baptismal fonts according to the decrees of the councils, that must be covered from a very ancient epoch, as they still are today.

Note 1.p.537. L'Architecture et les arts qui en dependent.IV.

The baptismal fonts of the parish church of the city of Cluny merit mention; cut in a block of stone, they assume the form of a hemispherical bowl inside, and are decorated externally

by four little columns supporting four seats, between which extends a frieze of dry leaves in good drainage (5). The four small basins formed by the seats each of these, and probably served for placing the salt, oil, the candles. At A we give the plan of that font; at B is the section. It dates from the middle of the 13 th century.

The baptismal fonts of the middle ages vary as much in form as in materials. The manner in which they are decorated permits the supposition, that great liberty was left to the artists. These fonts are polygonal, circular or even square, lobed, oval, a hollowed to the bottom of the face or like a vase; their surfaces are ornamented by foliage, simple mouldings, or by geometrical ornaments; they are cut in stone or marble, some in bronze or lead. Their covers are composed of wooden frames, sheets of metal, or are richly ornamented in form of cones or canopies, and can then only be removed by means of angles or little permanent cranes. There is no need to say that baptismal fonts in bronze, preceding the end of the last (13 th) century, were rare in France; some of them are still seen in Italy, Germany and Belgium.[1] The fonts of the cathedral of Hildesheim are particularly remarkable. "The font," says M. de Caumont,[2] from whom we borrow this description, "rests on four personages, each having one knee on the ground, and holding an urn, from which water flows over the pavement; these figures are emblematic of the four rivers of paradise; and on the circle borne by their shoulders is read the following inscription, explaining the symbolic relation of each of these rivers of paradise, [illegible]

Note 1.p.540. L'Arch. e.l.orte a. en Occ. Vol.IV. Hollabund.

Note 2.p.540. Bull. monum. Vol. XX. p.299.

The font is decorated by four reliefs representing the passage of Jordan by the Israelites under the lead of Joshua, the passage of the Red sea, the baptism of Jesus Christ, the Virgin and Child Jesus, before whom is the giver, bishop Wilbernus. Above the four rivers are 8 medallions representing Prudence and Isaiah, Temperance and Jeremiah, Justice and Daniel, Fortitude and Ezekiel. Above are seen the signs of the evangelists. The conical cover is likewise covered by reliefs. These fonts of the second half of the 13 th century are perhaps the most beautiful that exist, and those best composed by the choice

by four little columns supporting four heads, between which e extends a frieze of ivy leaves in good sculpture (5). The four small shelves borne by the heads had a use, and probably served for placing the salt, oil, and candles. At A we give the plan of that font; at B is its section. It dates from the middle of the 13 th century.

The baptismal fonts of the middle ages vary as much in form as in materials. The manner in which they are decorated permit the supposition, that great liberty was left to the artists. These fonts are polygonal, circular or even square, lobed, oval, h hollowed to the bottom of the font or like a bowl; their surfaces are ornamented by foliage, simple mouldings, or by geometrical compartments; they are cut in stone or marble, cast in bronze or lead. Their covers are composed of wooden frames, sheets of metal, or are richly ornamented in form of cones or canopies, and can then only be removed by means of angles or little permanent cranes. There is no need to say that baptismal fonts in bronze, preceding the end of the last (18 th) century, were cast in France; some of them are still seen in Italy, Germany and Belgium.[1] The fonts of the cathedral of Hildesheim ara particularly remarkable. "The font," says M. de Caumont,[2] from whom we borrow this description, "rests on four personages, each having one knee on the ground, and holding an urn, from which water flows over the pavement; these figures are emblematic of the four rivers of paradise; and on the circle borne by their shoulders is read the following injunction, explaining the symbolic relation of each of these rivers of prudence, temperance, courage and justice. (Latin inscription).

Note 1.p.540. L'Arch. e.l.arts q. en dep. Vol.IV. Gailhabaud.

Note 2.p.540. Bull. monum. Vol. XX. p.299.

The font is decorated by fair reliefs representing the passage of Jordan by the Israelites under the lead of Joshua, the passage of the Red sea, the baptism of Jesus Christ, the Virgin and Child Jesus, before whom is the giver, bishop Wilhelms. Above the four rivers are 8 medallions representing Prudence and Isaiah, Temperance and Jeremiah, Courage and Daniel, Justice and Eqekiel. Above are seen the signs of the evangelists. The conical cover is likewise covered by reliefs. These fonts of the second half of the 13 th century are perhaps the most beautiful that exist, and those best composed by the choice

of sculpture accompanied by inscriptions. In small size with the bronze fonts of Saint L. Lebuin at Deventer, which date from the end of the 15 th century. Around the base are placed the four evangelists in the round, and around the bowl are the 12 apostles in relief within an arcade of Gothic arches.

By the last of these monuments, remarkable by work and material, we insist that in France only fonts of small value. The church of Corneuil contains fonts, that present a certain interest. The bowl is of lead and dates from the 12 th century (?); around it are arranged 16 niches alternately filled by figures in half relief and ornaments. This font rests on a stone base with 4 sides, of a later epoch. The lid (probably of lead and in conical form) has been replaced by a wooden cover of the 16 th century.

There is seen in the church of Lombez a little baptismal font of lead in cylindrical form, divided in two zones; the upper zone represents arcades and the lower one has 16 figures in quatrefoils. The same model served five times for the upper zone, and in the lower zone the 16 figures that represent the religious orders are obtained by only four moulds. Thus this sort of fonts do not require a great cost of fabrication; casters or makers of copper pots also made them, doubtless with models kept in stock; thus in the example here given, the subject of the zones is evidently from the epoch preceding the little figures of the quatrefoils of the lower zone, which date from the second half of the 14 th century. A hole at the middle of the flat bottom of the font serves to empty it.

At Vieux is a font of the same dimensions in lead but with 8 sides, that presents on its exterior 16 arches formerly filled[1] by little figures in the round executed in circles. These fonts rest on a stone table borne by four little columns of the beginning of the 13 th century; the font is of the 12 th.

Note 1.c.113. These little figures have been removed.

As for the cantonal fonts of the middle ages, whose waters were moved by cranks or axles of iron, very beautiful examples are seen at Hal, S. Pierre of Louvain (Belgium), and S. Nicholas of Bruges. These examples being very well engraved in the work of M. Gailhabaud, it seems to me useless to return on their composition. Besides their style is foreign to

of subjects accompanied by inscriptions. We shall also cite t the bronze fonts of church S. Sebald at Nuremberg, which date from the end of the 15 th century. Around the base are placed the four evangelists in the round, and around the bowl are t the 12 apostles in relief within an arcade of delicate work.

By the lack of those monuments, precious by work and material, we longer find in France only fonts of small value. The church of Berneuil contains fonts, that present a certain interest. The bowl is of lead and dates from the 12 th century (6); around it are arranged 16 niches alternately filled by figures in half relief and ornaments. This font rests on a s stone base with 8 sides, of a later epoch. The old cover (probably of lead and in conical form) has been replaced by a wooden cover of the 16 th century.

There is seen in the church of Lambez a little baptismal font of lead in cylindrical form, divided in two zones; the upper zone represents a hunt and the lower one has 16 figures in quatrefoils (7). The same model served five times for the upper zone, and in the lower zone the 16 figures that represent the religious orders are obtained by only four models. Th Thus this sort of fonts do not require a great cost of fabrication; casters or makers of pewter pots that sold them, composed them with models kept in stock; thus in the example here given, the subject of the chase is evidently from the epoch p preceding the little figures of the quatrefoils of the lower zone, which date from the second half of the 13 th century. A hole A made at the middle of the flat bottom of the font serves to empty it.

At Visme is a font of the same dimensions in lead but with 8 sides, that presents on its exterior 16 arches formerly filled by little figures in the round supported on corbels.[1] These fonts rest on a stone table borne by four little columns of the beginning of the 13 th century; the font is of the 15 th.

Note 1.p.542. These little figures have been removed.

As for the baptismal fonts of the middle ages, whose covers were moved by cranes or angles of iron, very beautiful examples are seen at Hal, S. Pierre of Louvain (Belgium), and S. C Columba of Cologne. Those monuments being very well engraved in the work of M. Gailhabaud,[2] it seems to us useless to enlarge on their composition. Besides their style is foreign to

to French art.

Note 1.p.547. [illegible] Vol.II.

Sculptured on the internal surfaces of baptismal fonts are carved fishes, shells and frogs. These are seen in [illegible] (Brittany) baptismal fonts of the 12 th century composed of a sort of bowl supported by four [illegible] mutilated figures of [illegible] work. The interior of the bowl, cut like a [illegible], is ornamented by fishes and two fishes carved in the mass.

We shall terminate this article by giving the stone baptismal fonts with [illegible] ornamentation, that are placed near the portal of the cathedral of [illegible]; they date from the end of the 13 th century.

Also during the middle ages were used [illegible] fonts, [illegible] from the East, for baptizing infants. Everyone can see in Museum [illegible] at Paris the beautiful font of [illegible] work in which it is claimed that the children of S. Louis were baptized. (Old French poem).[1]

Note 1.p.544. William of Orange. Ballad of 11 th and 12 th centuries. Verse 7554 et seq. Baptism of Renouard.

When baptisteries were renounced, the baptismal fonts were placed in a closed chapel, as much as could be done. Thus, fonts must not only be covered, but in a place separated from the multitude of believers by an enclosure.

[illegible]. Side Arch.

An arch along the wall receiving the cross vault. (See Arc Formeret; Construction).

[illegible]. Ditch. Trench. Moat.

A deep trench made in the ground to oppose an obstacle around a camp, castle, city, park, or enclosure. There are dry ditches and ditches filled with water (moats), ditches with sloping or flat bottoms, ditches faced or not faced with masonry.

Dry ditches are those cut around castles, a camp, or a [illegible] located to [illegible] and retain water.

Wet ditches are those through which passes a stream of water, or that are filled by an inlet from sea, lake or pond.

Simple ditches are those simply excavated in loose soil, whose sides are at 45° degrees and are covered by turf.

to French art.

Note 2.p.542. L'Arch.e.l.arts qui en depend. Vol.IV.

Sometimes on the internal surfaces of baptismal fonts are carved fishes, shells and frogs. These are seen in church S. Sauveur of Dinan (Brittany) baptismal fonts of the 12 th century composed of a sort of bowl supported by four much mutilated figures of coarse work. The interior of the bowl, cut l like a cup, is ornamented by flutes and two fishes carved in the mass.

We shall terminate this Article by giving the stone baptismal fonts with singular ornamentation, that are placed near t the portal of the cathedral of Langres; they date from the e end of the 13 th century.

Also during the middle ages were used precious fonts, brought from the East, for baptizing infants. Everyone can see in Museum des Souverains at Paris the beautiful font of Persian work in which it is claimed that the children of S. Louis were baptized. (Old French poem).[1]

Note 1.p.544. William of Orange. Ballad of 11 th and 12 th centuries. Verse 7584 et seq. Baptism of Renouard.

When baptisteries were renounced, the baptismal fonts were placed in a closed chapel, as much as could be done. Today, fonts must not only be covered, but in a place separated from the multitude of believers by an enclosure.

FORMERET. Side Arch.

An arch agains the wall receiving the cross vault. (Arts Arc; Formeret; Construction).

FOSSE. Ditch. Trench. moat.

A long trench made in the ground to oppose an obstacle around a camp, castle, city, park, or enclosure. These dry ditches and ditches filled with water (moats), ditches with sloping or flat bottoms, ditches faced or not faced with masonry.

Dry ditches are those cut around castles, a manor, or a place located to high to conduct and retain water.

Wet ditches are those through which passes a stream of water, or that are filled by an inlet from sea, lake or pond.

Sloping ditches are those simply excavated in loose soil, w whose sides are at 45° degrees and are covered by turf.

Faced ditches are those with sides faced by masonry walls with a slight batter.

Ditches with flat bottoms have their sides faced, and thus windows can be opened in one side serving as substructure of a fortification. Ditches cut in the rock may also have flat bottoms.

The Romans excavated ditches around their temporary or permanent camps. Those ditches were usually 15 ft. wide at top. They were often double, being separated by a road 13.1 to 16.4 ft. wide. When Cesar established his camp opposite the Bellovacs on Mt. S. Pierre in the forest of Compeigne, "he caused the erection of a rampart 12 ft. high with parapet; he ordered the excavation before it of two ditches 15 ft. wide with flat bottoms; he caused to be built a great number of towers with three stories, connected by bridges and defensive galleries, whose fronts were covered by wicker mantlets, so that t the enemy was stopped by a double ditch and two rows of defenders; the first row on the upper galleries, where being higher and better sheltered, the soldiers shot arrows farther and w with more certainty; the second row behind the parapet and n nearer the enemy, where it was protected from arrows by the upper gallery.[1]

Note 1.p.345. De Bello Gollico. Book VIII. Chap. 9.

Country works that the Romans executed in Gaul had such influence on the art of fortification among us until a very late epoch in the middle ages, and in the time when casting machines had such small reach, ditches were such an important part of the art of defending places, that we must devote our attention to this curious passage. It is not necessary to know the locations here described by Cesar.

With the Commentaries at hand, the site of his camp was e evidently chosen on a plateau situated opposite Mt. S. Mark, that in old maps is designated by the name of S. Pierre-on-C Chastres.[2]This plateau has steep slopes on all sides, presenting on its top a broad horizontal area on which the little army that Cesar had with him could hold very easily, lending itself marvellously to the sort of defense, that he had adopted; a defense whose traces are further recognized at the locality itself.

Note 2.p.345. See Article of M. de Souley on the 8 th Book

of Cesar. Revue archaeologique. 1860.

Here they (1) is the section of the enclosing works. The assaillants could only reach the edge of the first ditch A by a ascending the long and very steep slope, and were seen with difficulty by the defenders placed at B; for the stronger reason they found themselves entirely masked from the defenders posted along the parapet C within the second ditch G. Those defenders placed at C were nearer, however the assailants than those posted at E on the galleries connecting the three-story towers, the line O C being shorter than the line E O. Assailants presenting themselves at K within arrow shot could only strike the defenders posted behind the parapet C by sending t their missiles in a parabolic line K L. Then the wicker work of the upper gallery E protected the soldiers posted at C. C Cesar describes very well the advantages of his works by saying that the soldiers placed at E saw the enemy farther off and could shoot at them with greater certainty. The assailants while climbing the slope P could only see the tops of the wooden towers and the galleries connecting them; they had no knowledge of the two ditches that would stop them at O. While ascending that slope, they were exposed to the arms with long reach from the upper defense; but as soon as they had reached the crest O, they not only found two obstacles before them to be passed over, but they were exposed to arrows from the gallery E and the rampart C, the latter arrows being shot directly, as indicated by the line C O, but also in a curved line as shown by the parabola H M. Admitting that the troops climbing the slope P had started, full of enthusiasm and arriving panting at O, it would have been very difficult for them to reach the parapet C. Meanwhile Cesar in the camp of Mt. S. Pierre did not fear a serious attack of the Belloracs; on t the contrary, he sought to draw them out of their own defenses. When he really feared an attack, his precautions were still greater. Around Alesia he established double lines of fortifications so as to blockade the army of Vercingetorix s shut up in that city, and to place himself on the defense against the considerable succors that threatened his camp. The enclosing line consisted of :- 1, toward the enemy a ditch 20 ft. wide anf of the same depth with flat bottom. At 400 ft. behind this ditch he established his intrenchments. In the

interval he caused two ditches to be dug, each 15 ft. wide and deep; the inner ditch was filled with water taken from the r river; behind those ditches he built a rampart 12 ft. high, f furnished with a parapet with slots. At the junction of the parapet and rampart, he planted strong palisades to prevent scaling. Towers were 24 ft. apart and flanked the entire entrenchment. These precautions did not seem sufficient to him after some sorties of the Gauls; he caused trunks of trees, b barked and sharpened, to be planted in the bottom of the ditch 5 ft. deep; five rows of these stakes were fastened together at bottom, so that they could not be pulled up. Before that obstacle, he caused conical holes 3 ft. deep to be dug in quincunx plan, at the bottom of which were set stakes hardened in the fire and pointed, that extended only 4 inches from the ground; these stakes were firmly fixed by tramping the earth around them; brambles concealed them from the eyes. These holes were arranged in 8 rows 3 ft. apart.(2). In front were fixed very close together stakes (3) one foot long and armed with iron spikes. In the memoir on the blockade of Alesia,[1] Prevost, captain of engineers, seems to us to have perfectly understood how these stakes were made, mentioned by Cesar. A Among the antique objects found near Alesia, says the learned officer, are noted iron spikes, that have solved for him the question of those stakes. These pieces of iron are 1 ft. long and 0.4 in. square at the middle; they are bent outward and pointed at each end. "All authors," adds M. Prevost, "who have spoken of Cesar's spikes, believed that they consisted of a r round wooden stake sunk in the ground with an iron point fixed therein and projecting above the soil. However simple might be that object, it is still difficult to execute; many stakes would have been split in trying to force in an iron spike; it would then have been necessary to point this by filing it cold, which would have required much time;" (then it would h have been necessary to have files); one would have needed to strike carefully on the head of the wooden stake to drive it into the ground without risk of splitting. All these minute t things are much appreciated by those having occasion to cause the rapid making of small articles in immense number by the f first men at hand.[2] Nothing is more easy with the spikes found at Alesia, similar to those with which we attach our guides

on the boring mandrels of mine furnaces. By the aid of two of these staples a spike is fixed on the side of the round stake one foot long. Held at C and D, the iron cannot slip on the wood in any direction, since its greatest dimension is at the middle," and the curvature strongly farces it against the wood." Perhaps two or three spikes were placed around the same stake; in the last case, it was necessary in forcing it into the ground to strike on its head by an intermediate block receiving the blows of the sledge; thus the object still better represents the meaning of the Latin text."

Note 1.p.548. Recherches sur le blocus d'Alesia. 1858. Leleux.

Note 2.p.548. By basing archaeological researches on practical observations, one can indeed arrive at serious discoveries, and M.Prevost is here perfectly correct, when he says that so many of these questions debated at such great length between archaeologists can really be solved only by practicians.

On their part the Gauls after the time of Cesar surrounded their camps and strong places by ditches excavated in the earth or even in the rock; the latter had vertical walls with a rampart inside. Thus were arranged the defenses of the Gaulish fortification still seen at the eastern extremity of Mt. Ganelon near Compiegne. The ditches of that place are 32.8 ft. in width with a depth of 9.8 ft. to 13.1 ft, and are separated from each other by a space of about 49.0 ft; a rampart 16.4 ft. high is built behind the second ditch. Great quantities of b boulders are laid on the bottoms of those ditches as obstacles.

The ditches of Gallo-Roman cities at the time of the invasion of the barbarians, such as those of Sens, Bourges, Beauvais, were very wide and were filled with water as much as possible.[1] The Gauls had further adopted the means of defense that the R Romans had employed against them, as Cesar himself stated; th those means must have been retained a long time. In the Roman du Rou, there is a question of ditches arranged in the new m mode, that had been frequently adopted in the 11 th century. (Old French poem).[2]

Note 1.p.549. The ditches of Sens were filled with water and had a width of about 66 ft.

Note 2.p.549. The Roman du Rou, verse 6893 et seq. This stratagem seems to have singularly pleased the historians of t that time; for they mentioned three times, viz:- 1, in 992 in

[illegible] Fulques, count of Anjou; 2. in the present case; 3. in the i[illegible] Aug. Le Prevost).

[illegible] and grass to conceal their openings.

[illegible] later castle Gaillard, still retain their ditches cut in the [illegible] these fortresses. (Art. Chateau). Passages likewise cut in [illegible] the ditches; they served especially to allow the garrison to [illegible] and towers, and to the precipices which bore them.

[illegible] tury, while after that epoch the ditches are nearly always [illegible] ved with slabs around castles built with care. The ditch of t the keep of Coucy (beginning of 13 th century) is paved; the great ditch before the gate of the castle of Pierrefonds also (beginning of the 15 th century). At the city of Carcassonne, there remain considerable fragments of the walls of the counterscarp of the ditches at the eastern side (end of 13 th century). The counterscarp of the wide ditch that separates the castle of Coucy from its bailey, was walled (beginning of 13 th century). The ditches of the castle of Vincennes were walled after the rebuilding of that castle during the 14 th century; those of the Louvre were walled after Charles V. Not only the [illegible] of the cities were surrounded by ditches, but also the abbeys located outside cities, and even sometimes o [illegible]

[illegible]

When artillery was employed to besiege places, the ditches were again enlarged, and men thought particularly of arranging the defenses to sweep them, covered ways to protect their approaches, low works to obtain a sweeping fire at the level of

the battle of Conquereil between Conan, duke of Brittany, and Fulques, count of Anjou; 2, in the present case' 3, in the i invasion of Aquitania by Scandinavians in 1019. (note of M. A Aug. Le Prevost).

How could they excavate ditches wider at bottom than at top? That is difficult to explain, unless it be around the sides were shored. We see that these ditches were covered with brush and grass to conceal their openings.

The Normans surrounded their fortifications by very wide a and very deep ditches, sometimes with a palisaded covered way on the outer crest. The castle of Arques of Tancarville, and later castle Gaillard, still retain their ditches cut in the rock at the top of the precipice, which serves as a site for these fortresses. (Art. Chateau). Passages likewise cut in the rock lead from the interiors of castles to the bottoms of the ditches; they served especially to allow the garrison to go out ts attack the miners, attached to the bases of ramparts and towers, and to the precipices which bore them.

We have not seeu walled counterscarps before the 13 th century, while after that epoch the ditches are nearly always walled around important fortresses, and their bottoms are paved with slabs around castles built with care. The ditch of t the keep of Coucy (beginning of 13 th century) is paved; the great ditch before the gate of the castle of Pierrefonds also (beginning of the 15 th century). At the city of Carcassonne, where remain considerable fragments of the walls of the counterscarp of the ditches at the eastern side (end of 13 th century). The counterscarp of the wide ditch that separates the castle of Coucy from its bailey, was walled (beginning of 13 th century). The ditches of the castle of Vincennes were walled after the rebuilding of that castle duriug the 14 th century; those of the Louvre were walled after Charles V.[1] Not only the castles of the cities were surrounded by ditches, but also the abbeys located outside cities, and even sometimes p parish churches.

Note 1.p.550. Souvel.

When artillery was employed to besiege places, the ditches were again enlarged, and men thought particularly of arranging the defenses to sweep them, covered ways to protect their approaches, low works to obtain a sweeping fire at the level of

the ground, cunettes to remove rainwater, dams and reservoirs to fill them, when streams and adjacent ponds permitted this. (Arts. Architecture militaire; Bastille; Bastion; Boulevard; Chateau; Porte; Siege). It was for the superior lord to regulate the extent and width of the ditches, and in certain cases he required them to be filled up. As for their maintenance, it was at the cost of the lord or at the expense of the vassals by special agreements. We find in a very curious collection published by M. A. Champollion-Figeac [2] the translation of a text in the Gascon language, that has for title:- "Also he o ordered it to be enclosed and armed against his enemies." [3] In this text, the passages relating to ditches are noted.

Note 2.p.550. Droits et usages etc. Paris. 1860. Leleux.

Note 3.p.550. Coll. Doct. Vol. CXLVII, folio 282. M. Champollion-Figeac does not give us the date of this text. From the nature of the defenses, it appears to be of the end of t the 14 th century.

"The manner of enclosing the city:- first, there should be all around it great, wide and deep ditches, so deep that water rises in them; and those places where water cannot be had, m must be made at bottom of the ditches a great number of "vosias", [4] covered by a layer of earth and grass; and after, there must be great and high walls with towers 58 ft. square for defense, and that the ditches be well cleared of grass and shrubs from the foot of the wall to the bottom. And at the gates and entrances, there must be drawbridges, and all the ways for entrance must be interrupted by great ditches in fiwe or six places, except a small and narrow passage, which should be broken when necessary, so that no one can approach the gates on foot or mounted, nor bring fire in a little car, nor in anything, and to make a great number of "vosias" by the entrance ways. [1]"

Note 4.p.550. M. Champollion-Figeac does not translate the word "vosias."

Note 1.p.551. It would seem that these "vosias" are little traverses or low cavaliers. Traces of those traveeses are found terraced in the descent of the barbican of the city of C Carcassonne, and even in the ditches excavated along the north front of that fortress.

We have often found traces of these interruptions made acr-

[illegible] walls leading to the gates. [illegible]
[illegible], and since the [illegible] always [illegible]
the ditches, so as to be swept in flank by the towers and cu-
rtains, the breaks extended into the enclosing ditch, so as
not to serve as refuge for the assailants; but these details
are explained in Art. Porte.

The little cities or communes built in the second half of
the 13 th century in Guienne are surrounded by ditches with
a wall; most of these little cities are perfectly regular, as
well as their defenses.[1] [illegible]
[illegible]
[illegible]
[illegible] in 1284 by Edward I. In this Latin text,[1]
we read the following relative to the walls and ditches.

Note 2.p.551. On this subject, M. A Champollion-Figeac appe-
ars to be astonished in his collection of "Droits," by what
we [illegible]
[illegible]
[illegible]
[illegible]
[illegible], etc., were [illegible]
by the superior lords of the 13 th century, and he adds conc-
erning the plan of Monpazier in particular: "The author [illegible]
[illegible] the plan of the last city. But it is
true that the author does not inform us whence he derived th-
is plan of a city of the 13 th century." We have taken this p-
lan from where M. Champollion-Figeac could have himself tak-
en it, i.e., that of Monpazier, "a pretty little city," says
the dictionnaire of M. Girault de Saint-Fargeau (Dordogne),
[illegible]
founded in 1284 under the direction of the lord de Puch, Jean
de Grailly; [illegible]
ts." There is in the work of M. Champollion-Figeac, in the
midst of reproaches full of interest, when he cites ancient
[illegible]
[illegible]
led by our imagination on the subject of castles, when we give
[illegible]
he seems to ignore that castle Gaillard is still standing in
great part, that its ditches cut in the solid rock are not

across roads leading to the gates. Those breaks were equipped with barriers, and since the roads nearly always ran along t the ditches, so as to be swept in flank by the towers and curtains, the breaks extended into the enclosing ditch, so as not to serve as refuge for the besiegers; but these details are explained in Art. Porte.

The little cities or communes built in the second half of t the 13 th century in Guienne are surrounded by ditches with a wall; most of those little cities are perfectly regular, as well as their defenses.[2] In regard to the commune of Sauveterre, M. Leo Drayn in the excellent work, that he has published on Guienne militaire, gives the text of the privileges granted to that commune in 1283 by Edward I. In this Latin text,[1] we read the following relative to the walls and ditches.

Note 2.p.551. On this subject, M. A Champollion-Figeac appears to be astonished in his collection of "Droits," by what we have advanced on this fact (sufficiently proved by the fine researches of M. de Vernheil and the works of M. Leo Drouyn, viz:- that the plans of the cities of Aigues-morts, Carcassonne, Villeneuve-le-Roy, Villeneuve-le-Archeveque, Sainte-Foy, Monpasier, Monsegur, Sauveterre, etc., were decreed in advance by the superior lords of the 13 th century, and he adds concerniug the plan of Mompasier in Perigord:- "The author (of the Dictionnaire) gives even the plan of the lost city. But it is true that the author does not inform us whence he derived this plan of a city of the 13 th century." We have taken this p plan from where M. Champollion-Figeac coulh have himself taken it, i.e., that of Monpasier, "a pretty littce city," says the Dictionnaire of M. Girault de Saint-Forgeau (Dordogne), Tot 29 miles from Bergerac, the chief place of the canton, f founded in 1284 under the direction of the lord de Buch, Jean de Grailly; well built and formed of wide and straight streets." There is in the work of M. Champollion-Figeac, in the midst of reproaches full of interest, when he cites ancient texts, many other singular interpretations. The learned compiler accuses us, for example, of allowing ourselves to be guided by our imagination on the subject of castles, wheu we give plans according to the existing monuments; among other things, he seems to ignore that castle Gaillard is still standiug in great part, that its ditches cut in the solid rock are not

[illegible] at Roche-Guyon we have found only one postern of the 13 th c century, and that on that pretext we build what we terms ret- [illegible] thy of serious criticism. There is no author, that one cannot [illegible] archives and libraries; he does not comprehend that one can distinguish the structure of the 12 th from the edifice of the 14 th century, without the help of the foundation documents. [illegible] demands proofs from us. It is merely as if one required the English to prove that they understand each other when they converse together. Learn English and you will have the proof.

Note 1.p.552. Published by the Com. of Hist. Monts. of the [illegible]

"Item, we will that soldiers and masters, citizens or inhabitants of said city be exempt from all communal labors, except those of bridges, walls, roads and walls of the city. [illegible] rks, the other neighbors in their turn are responsible for m misdemeanors committed by day or by night." Thus the settlements, i.e., the cities and charters were made by the lord [illegible] The feudal lords [illegible] the establishment of their little communes, the bishops excommunicated the founders and the inhabitants; but these objections and excommunications did not prevent the cities from being erected.

changed at all; he pretends in citing our mutilated text, that at Roche-Guyon we have found only one postern of the 13 th c century, and that on that fragment we build what re terms retrospective theories; however tourists that descend the Seine can see not only the castle but the keep intact, that surmount it. To combat what he presents as theories and systems, and to emphasize in us numerous contradictions, M. Champollion-Figeac fills several pages of his book with quotations from t the Dictionnaire; incomplete quotations with entercalated commentaries, interpretations or arsumptions; which are not worthy of serious criticism. There is no author, that one cannot make contradict himself by taking a part of a phrase here and another there, and connecting these fragments by the aid of comments. M. Champollion believes with the best faith in the world, that in the matter of monuments, France possesses only archives and libraries; he does not comphehend that one can distinguish the structure of the 12 th from the edifice of the 14 th century, without the help of the foundation documents. He does not at all admit classifications by schools, and he demands proofs from us. It is nearly as if one required the English to prove that they understand each other when they converse together. Learn English and you will have the proof.

Note 1.p.552. Published by the Comm. of Hist. Monts. of the Gironde. 1847.

"Item, we will that soldiers and masters, citizens or inhabitants of said citw be exempt from all communal labors, except those of bridges, wells, roads and walls of the city, labors for which men in the vicinity of the place are held, without any doubt of concurrence. As for us, we are held to make the fisst enclosure of the city, and the said soldiers and masters must watch day and night during the execution of the works, the other neighbors in their turn are responsible for m misdemeanors committed by day or by night." Thus the enclosures, i.e., the ditches and ramparts were made by the lord under the supervisiou of the commune, around the markets or market towns founded by special privilege of the superior lord. The feudal lords opposed the establishment of these little communes, the bishops excommunicated the founders and the inhabitants; but these objections and excommunications did not prevent the cities from being erected.

The walls of Avignon, begun in 1349 and ended in 1374, were surrounded by ditches 65.6 ft. wide and an average depth of 13.1 ft. below the crest of the counterscarp. This counterscarp was not entirely walled, but to avoid undermining by freshets in the Rhone, the bottom of the ditch was paved with large cut stones.[2] The Rhone, Sorgne and a branch of the Durance in ordinary times filled a great part of these ditches.

Note 2.p.362. The pavement is found 9.8 ft. below the surface of the ground, when the present owners of the ground over the ditches cause a well to be dug.

FOUR. Oven for Baking.

In the cities of France, the superior lord permitted the e establishment of ovens for bread; this was a privilege of the lay or secular lords, or for the abbeys, who desired a profit from it. Those common ovens were heated by the owners of the privilege, and were established in buildings to which everyone could bring his bread and have it baked by paying a royalty. Sometimes these common ovens were established at the expense of a feudal lord, and were freed from all dues by the superior lord. certain cities obtained the privilege of building as many ovens as it pleased the citizens to construct. In the towers of fortified cities were established ovens, so as to allow the garrison in case of blockade to bake its bread without having recourse to the inhabitants or to the common ovens. Most keeps also possessed their oven. (Arts. Architecture Militaire, Chateau, Donjon, Porte, Tour).

Lime kilns, no more than ovens for bread, could not be established without permission of the sovereign lord.

FOURCHES PATIBULAIRES. Gibbets. Gallows.

"The local high justices," says M. A. Champollion-Figeac,[1] "could not erect as many gibbets as they desired to establish. The ordinance of king John of 1345 and 1346 appears to sufficiently indicate this. But the wise monarch Charles V added a new privilege for certain localities, that of having gibbets with two piers. The abbey of Cluny obtained this permission by favor in the month of September, 1360.[2] Do not omit a last fact, which will prove that it was not permitted to ornament these atrocious instruments of punish ent by other signs, than

the king desired to be placed there. The count of Foix having placed his shield of arms on the top of a gallows established at Plan de Cayres at that city, the procureur of Beaucaire had immediately informed that the king formally objected to its being placed there, and that the count should be arraigned before the high justice of the monarch. It is true that this gallows erected by the count of Foix represented in this case the [illegible] possession of the high justice of the place; but it is the very act for a lord of Beaucaire to choose that occasion to uphold the claims of his arms." That was a privilege; the evil was to use this if he had not the right.

Note 1.p.[illegible]. Procès et enquêtes, p. 121.

Note 2.p.553. *Coll. de chartes et diplomes*, box 227.

In regard to this, and to prove to what point the king was jealous of his rights of jurisdiction, during the sojourn of the Popes at Avignon a notorious malefactor was arrested by the officers of the pontifical justice, and crossed the arm of the Rhone before the city, called [illegible] in the island [illegible]let de Tailla[illegible]. The Pope's men landed there at the same time as the criminal, took possession of the person, and hung him on a gallows erected there by their order. The corpse of the man executed was buried after proper delay. These facts were not reported till long after to the officers of the king of France, who demanded the Pope's men of having encroached on the seigniorial rights of the King; the officers of the Pope alleged in their defense, that they had no intention to usurp the royal jurisdiction, but they believed that they had [illegible] the country of a [illegible] see. The royal judges did not [illegible]: but so that this precedent could not be invoked later against the rights of their sovereignty, they in their turn went to the island of la Motte, there proceeded against the punished man, and after having held a regular trial, hung him again in effigy on the gallows with the arms of the king.

Note 1.p.554. Information furnished by M. Achard, archivist of the prefecture of Vaucluse.

The right of high, middle and low justice belonged to feudalism: the great vassals holding directly from the sovereign infeoffed certain parts of their domains to vassals of lower rank; and these latter, likewise, infeoffed new fiefs, whose seigniority they reserved. At the same time with these

the king desired to be placed there. The count of Rodez having placed his shield of arms on the top of a gallows established on place Carmes in that city, the seneschal of Rouerque was immediately informed that the king formally objected to its being placed there, and that the count would be arraigned before the high justice of the monarch. It is true that this pl- placing by the count of Rodez represented in this case the t taking possession of the high justice of the place; but it wa was very bad for a lord of Rouerque to choose that occasion to parade the blazon of his arms," that was a privilege; the evil was to use this if he had not the right.

Note 1.p.553. Droits et usages. p. 165.

Note 2.p.553. Coll. de chartes et diplomes, box 267.

In regard to this, and to prove to what point the king was jealous of his rights of jurisdiction, during the sojourn of the Popes at Avignon a notorious malefactor was pursued by t the officers of the pontifical justice, and crossed the arm of the Rhone before the city, taking refuge in the island called du Mouton. The Pope's men landed there at the same time as the criminal, took possession of his person, and hung him on a gallows erected there by their order. The corpse of the man punished was buried after proper delay. These facts were not reported till long after to the officers of the king of France, who accused the Pope's men of having encroached on t the seignorial rights of the king; the officers of the Pope alleged in their defense, that they had no intention to usurp the royal jurisdiction, but they believed that they had rid t the country of a dangerous man. The royal judges did not insist; but so that this precedent could not be invoked later against the rights of their sovereign, they in their turn went to the island of du Mouton, there proceeded against the punished man, and after having held a regular trial, hung him again in effigy on the gallows with the arms of the king.[1]

Note 1.p.554. Information furnished by M. Achard, archivist of the prefecture of Vaucluse.

The right of high, middle and low justice belonged to feudalism; the great vassals holding directly from the sovereign infeoffed certain parts of their domains to vassals of lower rank; and these imitating them, likewise constituted new fiefs, whose sovereignty they reserved. At the same time both ceded

their right of justice over certain areas to the territory, however not without some reserves in that transfer, but limiting more or less the extent of the power that they granted.[2] The gibbets consisted of stone piers connected at the top by cross beams of wood from which were suspended the criminals; either when hung on the gibbets themselves, or after execution elsewhere, they were then exposed to the view of passers. The number of piers varied according to the rank of the lords; simple gentlemen as high justices had two, castellans had three, barons four, counts six and dukes eight; the king alone could have as many as he thought proper." He could also suppress gibbets, whose establishment he had permitted. In 1487,[3] "the king's attorney at the Chatelet went to various places in the provostry and vicinity of Paris to cause to be demolished the gibbets, carquans, ladders, and other marks of high justice, in consideration that king Louis XI had granted to several t the right of high justice, which was revoked by the edict of general revocation of all grants in a portion of the domain alienated after the death of Charles VII, which was issued by Charles VIII on his accession to the crown."

Note 2.p.554. Des anciennes fourches patibulaires de Montfaucon, by A. de Lavillegille. Paris. 1836. Techener.

Note 3.p.554. Comptes et ordinaires de la prevote de Paris. Sauval. Vol. III, p.481.

The gibbets, states Loyseau,[4] were placed in the midst of f fields, near the roads and on the hill. Indeed, many elevated places in France in the vicinity of abbeys and residences of lords have retained the name of justice or great justice.

Note 4.p.554. Traite des seigneuries. -- Jacquot, traite d des justices.

Certain gibbets were made of wood, composed of two posts w with cross beam at top and braces; but we do not have to occupy ourselves with those, which have no monumental character. Among famous gibbets, that can be regarded as edifices, it is necessary to cite in the first line the gibbet of Montfaucon. Sauval states, "that from the year 1188 and perhaps before, t there was a gibbet on the hill of Montfaucon," and he adds, " that it is a gentle elevation between the sububs of S. Martin and of the Temple, in a place to be seen from some leagues around it. On the top is a mass of masonry accompanied by 16

steps,[1] to which leads a flight of stone steps of sufficient width, formerly closed by a good gate. The mass is a parallelogram, [illegible] ft. deep and [illegible] ft. wide, terminated by a platform, and composed of 10 or 12 courses of great blocks of stone well bonded and [illegible], [illegible] with wide joints. The great square piers are [illegible] ft. high, made of [illegible] great stones with good joints [illegible], like the foundation, also well fastened and anchored, [illegible] the [illegible]. To connect them together and to attach the criminals, fixed on their tops are the great wooden beams [illegible] between them, with iron chains in the intervals. At the middle was a cellar into which were apparently thrown the victims of the criminals, when only the skeletons remained, [illegible] all [illegible] were consumed. [illegible] the gate of the stone is broken; of the piers [illegible] three or four remain standing, the others being overthrown or partly ruined."

[1] [illegible]

"To each his own is justice:
At Paris are 16 police officers;
At Montfaucon 16 pillars.
Each has its advantage.

[illegible]
[illegible]
16 pillars of its chapel
will be as many tombs."

Monsieur Sauval does not tell us from what sources he obtained his information, different documents[2] establish the existence of the gibbet at Montfaucon, at least from the 13th century. -- An agreement of the month of September 1233, between the prior of S. Martin-des-Champs and the chapter of Notre Dame contains the following passage (Latin). -- An act of sale of the month of June, 1249:- (Latin).[3] It results from these two documents, that in the years 1233 and 1249, [illegible] de [illegible]ville, there existed a gibbet on the area of the common [illegible] was the gibbet of Montfaucon [illegible] as evidently speaks of [illegible]. In a [illegible] aux trois [illegible], which dates from about 1270, there is mention of a certain Tibot hung at the gibbet of Montfaucon. There is

piers,[1] to which leads a flight of stone steps of sufficient width, formerly closed by a good gate. The mass is a parallelogram, 12.8 to 19.2 ft. high, 38.4 to 44.8 ft. long and 32.0 or 38.4 ft. wide, terminated by a platform, and composed of 10 or 12 courses of great blocks of stone well bonded and cemented, rusticated or with sunk joints. The great square piers are 32 to 33 ft. high, made of 32 or 33 great stones with sunk joints or rusticated (with bosses), like the preceding, also well fastened and cemented, being arranged in two rows lengthwise and one crosswise. To connect them together and to attach the criminals, fixed on their caps are two great wooden beams passing between them, with iron chains in the intervals. At the middle was a cellar into which were apparently thrown the bodies of the criminals, when only the skeletons remained, or all chains and places were occupied. Now that cellar has fallen in, the gate of the steps is broken; of the piers scarcely three or four remain standing, the others being entirely or partly ruined."

Note 1.p.555. Satyre menippe.

"To each his own is justice;
At Paris are 16 police officers;
At Montfaucon 16 pillars.
Each has its advantage.

16, Montfaucon calls you,
Tomorrow cry the ravens,
16 pillars of its chapel
Will be as many tombs.

Although Sauval does not tell us from what sources he obtained his information, different documents [2] establish the existence of the gibbet at Montfaucon, at least from the 13 th century. -- An agreement of the month of September, 1233, between the prior of S. Martin-des-Champs and the chapter of Notre Dame contains the following passage (Latin). -- An act of sale of the month of June, 1249;- (Latin).[3] It results from these two documents, that in the years 1233 and 1249, adds M de Lavegille, there existed a gibbet on the area of the common manor. now the gibbet of Montfaucon being found just in that manor, he evidently speaks of that. In the romance of Berthe aux grans pies, which dates from about 1270, there is mention of a certain Tibot hung at the gibbet of Montfaucon. There is

then reason to believethat Pierre de Brosse or Enguerand de M Marigny, to whom are attributed the building of the gibbet of Montfaucon, only repaired or rebuilt it. The work of stones cut with bosses mentioned by Sauval would cause the belief, t that this edifice was entirely rebuilt at the beginning of t the 14 th or the end of the 13 th centuries, that sort of masonry being then much used for civil structures. This monumental gibbet was situated beside the old road of Meaux, not f far from the barrier du Combat.[1] As M. De Lavillegille observes, the 16 pillars of the edifice of Montfaucon were still connected (which Sauval does not explain and could not clearly indicate,(since in his time the gibbet the gibbet was ruined) by intermediate cross beams of Wood. Louis X "commended Enguerrant to be hung and strangled, to the highest wooden cross beam of the gibbe of Paris. Paviot was punished likewise, except that he was hung beneath Enguerrant."[2] The tapestry of the city hall of Paris (plan of Paris) indicates the gibbet of Montfaucon with three wooden cross beams. Further, Sauval in his Comptes et ordinaires de la Prevote de Paris,(Vol. III,p.278), gives the following passage, which is important (1425, Charles VII).

Note 2.p.555. Des anciennes fourches potibulaires de Montfaucon, by A. de Lavillegille.

Note 3.p.555. Archiv. de l'empire. Sect. dom. S. 216. Titles of the fief of the common manor formerly possessed by the chapter of Notre Dame of Paris.

Note 1.p.556. See plan of Verniquet.

Note 2.p.556. Goguin. Grandes chroniques de France.

"Works and repairs made in the grand gibbet of Paris. To --, for having made in the said gibbet the requirements hereafter; i.e., for having shoveled and cleared the earth around the w walls that enclose the said gibbet, forty ft. along its walls; and if they have been cleaned and whitewashed. Place within that enclosure,:and also have whitewashed all the said walls of the pillars and beams of the said gibbet, both within and without, with lime and glue, I believe (chalk), and scaffolds, labor of workmen, do this, etc."

"To --, stonecutters and masons for having removed several old blocks (of stone) that were broken and cracked, both on the angle piers and the intermediate piers, and the walls enc-

enclosing that gibbet; and instead of them have brought and [illegible]

filled with plaster all the joints of said walls, and for ha-
ving removed and replaced all the stone cornices of the said
walls around the said gibbet, and having made two side walls
[illegible]
one of the intermediate piers in place of two others, that w
[illegible]
done, they should receive, etc."

In 1456 we read in the same Comptes (p. 239) this passage;
"To the great gibbet of Paris were fastened and nailed [illegible]
[illegible] by the master of justice."
In 1457 the gibbet of Montfaucon threatened ruin, for the Com-
ptes de la prevote contained this item (p. 476): "and also was
made a gibbet adjoining the great gibbet, that is in danger of
falling from day to day."

The condemned were hung to the cross beams by means of lad-
ders which they had to ascend, preceded by the hangman. [illegible]
[illegible]
and descending, removed the ladder."

[illegible]

According to the description of Sauval and several [illegible]
documents. [illegible]
aucon. Considering their height (at least 32.8 ft.), the piers
could not have been less than 2.? ft. square; the 16 piers
being "raised on the [illegible]," must leave
15 spaces between them of [illegible] ft. on the larger and of [illegible] ft.
on the two shorter sides. Then there could be but one chain
to each cross beam at the short sides and at most two for e
those of the large one. The cross beams being three in number,
[illegible]
[illegible]
that could serve. The cross beams were necessarily double.

enclosing that gibbet; and instead of them have brought and set 40 double blocks, and a "carton" of white through stones, and filled several holes in the exteriors of said walls, and filled with plaster all the joints of said walls, and for having removed and replaced all the stone cornices of the said walls around the said gibbet, and having made two side walls at the entrance of the said gibbet, raised and reset the steps of cut stone at the said entrance, and replaced 48 old beams, that had been removed and thrown down from the said gibbet, and set 48 others that are new, and set two caps of stone on one of the intermediate piers in place of two others, that w were worn and injured by water and frost, for what they have done, they should receive, etc."

In 1466 we read in the same Comptes (p. 389) this passage; "To the great gibbet of Paris were fastened and nailed 52 iron chains to serve for hanging and strangling malefactors, that have been and will be placed there by the decree of justice." In 1485 the gibbet of Montfaucon threatened ruin, for the Comptes de la prevote contained this item (p. 476); "and also was made a gibbet adjoining the great gibbet, that is in danger of falling from day to day."

The condemned were hung to the cross beams by means of ladders which they had to ascend, preceded by the hangman. "Eight great new ladders extend above each cross beam so that the s sufferer had his head at the desired height; the hangman mounted to the top of the laddeer, passed the chain around his neck, and descending, removed the ladder."

Note 1.p.557. Comptes et ordinories. Sauval. Vol. III. p.538.

According to the description of Sauval and several graphic documents,[2] here is the plan (1) at A of the gibbet of Montfaucon. Considering their height (at least 32.8 ft.), the piers could not have been less that 3.3 ft. square; the 16 piers b being "ranged on the breadth and one lengthwise," must leave 15 spaces between them of 4.9 ft. on the larger and of 3.9 ft. on the two shorter sides. Then there could be but one chain to each cross beam at the short sides and at most two for t those of the large one. The cross beams being three in number, that made 60 chains. This explains the number of 52 new chains furnished in 1466; perhaps there remained several old ones that could serve. The cross beams were necessarily doubled,

both to fasten the chains as well as to allow the hangman on them, and to preperly shure such high piers. Then there were 90 cross beams or only 60, if the lower beams were single. T The furnishing of 48 new cross beams in 1425 therefore is not surprising.

Note 2.p.557. Topestry of the city holl, view of hospitol S. Louis, 1641. Chotillon Cholmois. View of hospitol S. Louis. Perelle.

The height of the piers (admitting that the tapestry of the city hall indicates one cross beam too many) can leave no doubt of the number of those cross beams. Men would not have erected piers more than 32.8 ft. high to place but one upper cross beam and a single intermediate beam, for then would have been lost places in height; now it is certain that they held to having the greatest possible number of them.

One sees at B on the plan A the cellar indicated by dotted lines, with its opening C, intended for casting down the corpse and remnants, its door for removal being at Da At E is d drawn the section made on a b and showing the steps with the side walls repaired in 1425, and the portal fitted with leaves, that Sauval mentions. The ladders were raised at the time of the execution, and they were probably placed on the platform.

Sometimes the cellar intended to serve as a receptacle for the remains of the executed was so filled, that the platform was strewn with fragments, the chains suspended skeletons, so that it was necessary to make a general removal and to bury the decayed or dried remains. For example, this operation was necessary, when it was required to replace the beams, that o occurred quite frequently.

At the foot of the hill on which rose the gibbet of Montfaucon on the West, had been erected a stone cross, some authors state, by pierre de Craon in memory of the decree that this lord had obtained from Charles VI in 1396, by which confessors were granted to the condemned. But this cross would seem rather to have been placed there in 1403, after the execution of two scholars of the University ordered by the provost of Paris. In fact, Monstrelet [1] reports the case thus; "M. William of Tigouville, provost of Paris, caused to be executed two clerics of the University; i.e., one named Logier of Monthilhier, who was a Norman; and the other named Olivier Bourgeois, who

was a Breton; who were charged with having committed several thefts in different cases. And because notwithstanding they were clerics, and that when taken to the gibbet they cried lo loud and clear, "clergy"; so as to be rescued; yet (it is said) that they were executed and hung on the gibbet; and then by t the charges of the University the said provost was deprived of all royal office. And that he was condemned to erect a cross of cut stone, great and high, quite near the gibbet on t the road from Paris; on which were carved the images of those two clerics. And besides they were taken down from the said gibbet, and placed on a cart covered by black cloth; thus being accompanied by its sergeants and other persons carrying lighted wax candles; they were taken to S. Mathurin and there restored by the provost to the rector of the University."

Note 1.p.559. Chroniques. Chap. 18.

We give (2) a view af that edofice on the front side facing the southwest. The steps being understood to be placed at the rear, the condemned were brought on the platform after having gone around the massive masonry base. At the bottom of our Fig. is placed the cross of William of Tigouville, also indicated in the tapestry of the city hall.

Fig. 3. presents the entrance side of the gibbet.

It does not appear that there existed on the territory of France other gibbets with such a monumental appearance. This was not the only one at Paris; there existed a gibbet outside gate S. Antoine, one on the land of the city behind the bishop's palace, one on the site occupied today by the western end of place Dauphine, one at Champeaux, one behind the gardens of Petits-Augustins, quite near the top of Rue S. Benoit, and that was on the lands of the abbey of S. Germain-des-Pres. The last gibbet, like many others, consisted of four stone posts with four cross beams of wood. It is represented in the tapestry of the city hall and in the great plan of Merian. Others again were composed of two piers with a single cross beam, or of t three piers set at the angles of an equilateral triangle with three crowning cross bars. The hideous appearance of these edifices, and the horrible odor exhaled from them, did not prevent the establishment of wineshops, tea-gardens, and places of debauchery in their vicinity. (Old French poem). [1]

Note 1.p.561. Lo Repeu faicte aupres Montfaucon. Poem attrib-

attributed to Villon. Edit. Jonnet.p.292. 1854.

"Not far from Montfaucon," says M. de Lavillegille,[2] "is p found another smaller gibbet, that bears the name of Montigny. Built and demolished several times, it seems to have been intended only to supplement temporarily the great gibbet, when that required some repairs. The first mention of the gibbet is in the year 1328. It no longer existed at the beginning of the 15 th century, since in 1416 it was necessary to construct a temporary gibbet, while awaiting the work then being done at Montfaucon." That gibbet consisted of four wooden posts 1 ft. square and about 20 ft. high, their feet set in a supporting wall 2 ft. thick and of about the same height. Four cross beams connected the heads of the four posts.[1]

Note 2.p.561. Les anciennes fourches patibulaires.

Note 1.p.5..2. Sauval. Vol. II. p.612. -- Felibien. Vol. I, p.564. Pieces justificatoires. B.

Gibbets served as places for exhibiting the condemned executed at other places, and that had even not been hung. The bodies of decapitated persons were placed in sacks; these were also exposed on gibbets, suicides, and effigies representing persons condemned in contumacy. The corpse of admiral de Coligny was suspended by the feet on the gibbet of Montfaucon. L'Etoile reports that Catherine de Medici, "to please her eyes, went one evening to see it, taking there her sons, daughter and son-in-law." Since then these gibbets rarely served for executions or exhibitions. Still Sauval states that he s saw several corpses there still, although that edifice was i in ruins.

Gibbets not only served for hanging men, but criminals were also suspended there, particularly hogs condemned to that sort of punishments by judgments and orders made for having devoured children. (On this subject see the pamphlet of M. E Agnel. Curiosities judiciaires et historiques du moyen age. Paris. Demoulins. 1858). In such a case the judicial formalities of the time were scrupulously followed, and it was the custom to hang the condemned in their clothes, and an animal was clothed when led to the gibbet. "In 1386 a sentence of the judge of Falaise condemned a sow to hang for having killed an infant. That sow was executed on the place of the city in man's clothing."[2]

Note 2.p.562. Curios. judic. M. E. Agnel.

In 1314,[3] a bull that had killed a man was judged and hung on the gibbet of Moisy-le-Temple. There was an appeal from t the sentence. The judgment was found just; but it was decided that the count of Valois had no right of justice on the territory of Moisy, and that his officers should not have executed it.[4]

Note 3.p.562. Carlier. Histoire du duche de Valois. Vol. II. p. 207.

Note 4.p.5_2. Saint-Foix. Essais hist. sur paris. Vol.V.p. 100. 1776.

FRISE. Band. Frieze.

A running ornament filling a horizontal course under a band or cornice. In Roman architecture by frieze is understood the plain or decorated course found between the architrave and c cornice. The arcchitecture of the middle ages no longer using the entablature of the antique orders, does not have friezes, properly speaking. However, the name of frieze in Romanesque or Gothic architecture is given to bands, when they are ornamented by sculptures. (Arts. Bandeau; Corniche; Sculpture.

FUT. Shaft of Column.

The part of the column between the base and the capital. ((Arts. Colonne; Construction).

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